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GEMINI ATLAS AGENA TARGET VEHICLE SYSTEM

MANAGEMENT AND RESPONSIBILITIES AGREEMENT

BETWEEN THE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER

AND

THE UNITED STATES AIR FORCE
AIR FORCE SYSTEMS COMMAND
SPACE SYSTEMS DIVISION

MARCH 1965

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NASA MSC AND AFSSD
MANAGEMENT AND RESPONSIBILITIES AGREEMENT
for the
GEMINI ATLAS AGENA TARGET VEHICLE SYSTEM PROGRAM

1.0 PURPOSE.

1.1 This document delineates the management responsibilities of the Air Force Systems Command (AFSC), Space Systems Division (SSD), and the National Aeronautics and Space Administration (NASA), Manned Spacecraft Center (MSC) for the conduct of the Gemini Atlas Agena Target Vehicle Program, an essential part of the Gemini Program. Further, this document clarifies and supplements the agreements between the Department of the Air Force and the NASA, dated September 15, 1960, and in the NASA-DOD Operational and Management Plan for the Gemini Program, dated December 29, 1961.

1.2 Implementation. These agreements shall be contractually implemented by means of appropriate statements of work issued by MSC to SSD amending applicable NASA Defense Purchase Requests.

2.0 NOMENCLATURE.

For the purpose of this agreement, the following vehicles and system nomenclature, as illustrated in Figure No. 1, shall apply.

2.1 Gemini Atlas Agena Target Vehicle System (GAATVS). The GAATV System consists of the GAATV and all equipment, procedures, facilities and personnel required to accomplish the checkout, launch, and accomplish the performance requirements for the GAATV.

2.2 Gemini Atlas Agena Target Vehicle (GAATV). The GAATV consists of all equipment which lifts off the launch pad, i. e., the Atlas (Air Force designation SLV-3) and the GATV.

2.3 Gemini Agena Target Vehicle (GATV). The GATV consists of all equipment forward of the Atlas/Agena interface.

2.4 Gemini Agena Target (GAT). The GAT consists of the equipment which is literally the rendezvous and docking target for the Gemini Spacecraft, i. e., the GATV less all dropable items (booster adapter, shroud, horizon sensor fairings, etc.).

2.5 Gemini Agena (GA). The Gemini Agena (Air Force designation S-01C) consists of all equipment forward of the Atlas/Agena interface and aft of the Target Docking Adapter/Agena interface.

2.6 Basic Agena D. The Basic Agena D consists of the Standard Agena D (Air Force designation SS-01B) with the multi-start engine (Bell Model 8247) installed.

2.7 Target Docking Adapter (TDA). The TDA is the forward structure of the Gemini Agena Target which provides the mechanism for connecting the Gemini Spacecraft to the GAT to form a single structural unit in the docked configuration.

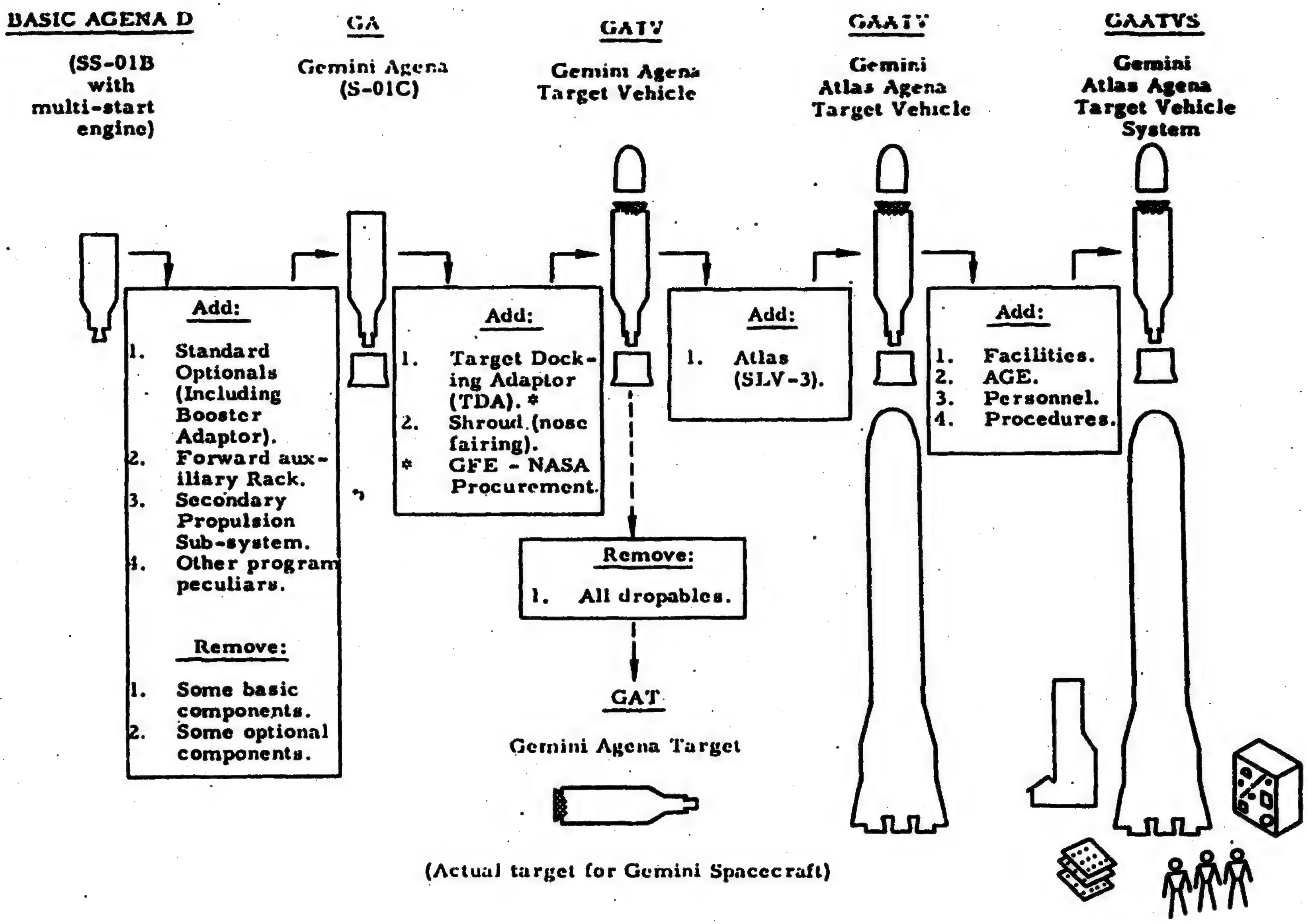
BASIC AGENA D
(SS-01B with multi-start engine)
GA
Gemini Agena (S-01C)
GATV
Gemini Agena Target Vehicle
GAATV
Gemini Atlas Agena Target Vehicle
GAATVS
Gemini Atlas Agena Target Vehicle System
Add:
1. Standard Optionals (Including Booster Adaptor).
2. Forward auxiliary Rack.
3. Secondary Propulsion Sub-system.
4. Other program peculiars.
Remove:
1. Some basic components.
2. Some optional components.
Add:
1. Target Docking Adaptor (TDA). *
2. Shroud (nose fairing).
* GFE - NASA Procurement.
Remove:
1. All dropables.
GAT
Gemini Agena Target
(Actual target for Gemini Spacecraft)
Add:
1. Atlas (SLV-3).
Add:
1. Facilities.
2. AGE.
3. Personnel.
4. Procedures.

Figure 1. Configuration Nomenclature

3.0 OBJECTIVES OF PROGRAM

3.1 Gemini Program Objectives. The Gemini Program has been established to provide a flexible space vehicle system which can be used to explore the many problems of manned operation in a space environment. The following specific objectives have been selected for the Gemini Program:

- a. Long duration mission
- b. Rendezvous
- c. Maneuvering in space before and after docking
- d. Extravehicular activity
- e. Provide a platform for scientific experiments.

3.2 GAATVS Objectives. The Gemini Atlas Agena Target Vehicle System will have several objectives in the Gemini Program. These objectives are:

- a. Provide a target vehicle for rendezvous and docking.
- b. Provide a larger launch window for the Gemini Spacecraft by a GAT orbital plane-change capability.
- c. Provide an orbital change capability for the Gemini Spacecraft and the Gemini Agena Target when docked.

4.0 MANAGEMENT OF PROGRAM

4.1 General

4.1.1 Gemini Program Office. NASA responsibilities and authority for overall program management, direction, systems engineering and operations will be accomplished by the NASA MSC through the MSC Gemini Program Office (GPO) which, as a management group, will be the central point of decision making and control for all facets of the program. The Resident Manager, Gemini Program Office, located at Cape Kennedy, is the representative of the GPO in conduct of its functions at the Air Force Eastern Test Range (AFETR).

4.1.2 Space Systems Division. Air Force responsibilities for acquisition of the GAATVS (less the TDA) and launch of the GAATV in support of the Gemini Program will be accomplished by the Air Force Systems Command through the SSD, acting as contractor to MSC.

4.1.3 Gemini Agena Program Office. SSD will establish a Gemini Agena Program Office (GAPO) which will be the central office for all GAATV system management, program administration and coordination of activities of other Air Force supporting elements.

4.1.4 Aerospace Test Wing. The 6555th Aerospace Test Wing (ATW) will function as the on-site manager for all SSD activities at the Air Force Eastern Test Range (AFETR).

4.1.5 Aerospace Corporation. The Aerospace Corporation will be used in a technical surveillance role on the SLV-3 vehicle portion of the GAATV Program. Assignments to the Aerospace Corporation on the SLV-3 Program will be controlled by the SSD SLV-3 Program Director;

however, any increases in Aerospace Corporation support which will increase costs on the Gemini Program must have GPO approval prior to implementation. Assignment of other than SLV-3 tasks to the Aerospace Corporation on the GAATV Program must have the approval of GPO.

4.2 Gemini Program Office.

4.2.1 Coordination Meetings. The coordination meeting system established by the GPO for management of the Gemini Program shall be used to provide simultaneous information and data to all cognizant organizations, and to insure that all such organizations are a party to resulting action and direction. Meetings are regularly scheduled, agenda are coordinated, and the proper people are requested to attend in order to resolve the problems posted. Program Office management methods utilize the coordination meeting tool for application to the technical and administrative problems in this complex management area.

4.2.2 Interface Control Panel. An Interface Control Panel has been established which is composed of representatives from all agencies involved, i.e., MSC, SSD, McDonnell Aircraft Corporation (MAC), and Lockheed Missiles and Space Company (LMSC). The activities of this panel are associated with the interfacing systems between the TDA, Gemini Spacecraft, and Gemini Agena, as specified in the Gemini/Agena Interface Specification and Control Document (ISCD-2). Direction from this group will appear as changes to the specification (ISCD-2). The procedure is delineated in the ISCD-2. When the actions of this group determine that direction to contractors is necessary, the direction will take place through management channels as determined by the fundamental responsibilities previously established. The minutes of the Interface Control Panel shall be reviewed and approved at the regular coordination meetings.

4.2.3 **Spacecraft Guidance and Control Panel** Discussion of problems and plans encountered in guidance, control, rendezvous and events are coordinated in regularly scheduled meetings between representatives of all the agencies involved, i.e., MSC, SSD, MAC, and LMSC. When the actions of this group determine that direction to contractors is necessary, the direction will take place through managements channels as determined by the fundamental responsibilities previously established. A report from these Spacecraft Guidance and Control Panel meetings shall be made at the regular coordination meetings.

4.2.4 **Trajectory and Orbit Meetings.** These meetings are the focal point of trajectory oriented mission planning. Flight plans and techniques are developed for all mission phases. GAATV related activity is as follows:

a. Establishment of the GAATV launch guidance criteria.

b. Selection of nominal GAT orbit characteristics such as inclination, altitude, maneuver accuracies, and error analysis work with regard to possible mission maneuvers.

c. Selection of GAT maneuver points and maneuver objectives which include maneuver logic, coordination with associated Gemini Spacecraft and ground control activities for both pre- and postdocking maneuvers.

When actions of this group determine that direction to contractors is necessary, the direction will take place through management channels as determined by the fundamental responsibilities previously established. A report from these Trajectory and Orbit meetings shall be made at the regular coordination meetings.

4.2.5 **Other Representation.** GPO will maintain in-plant representation at LMSC, and representation as observers on the SSD GATV Configuration Control Board. GPO will also participate with SSD in various meetings as required.

4.3 Contractual Activities.

4.3.1 Contractual Implementation. Contractual direction from MSC to SSD will be provided in the form of NASA Defense Purchase Requests which will include Statements of Work covering supplies or services to be procured by SSD, a schedule of delivery requirements, appropriate funding and such other instructions, limitations or conditions as may be appropriate. The Purchase Request and Amendments thereto will be issued by the MSC Contracting Officer, as a result of direction by the Gemini Program Manager, and will be processed to the SSD GAPO through the SSD Comptroller (Programs Division). Upon acceptance of each Purchase Request or Amendment thereto, SSD will effect procurement action within the guidelines specified therein.

4.3.2 Technical Direction and Guidance. Technical direction and guidance of the work under these Purchase Requests will be carried out by the MSC GPO. Technical instructions with respect to projects and project approaches, redirection of technical efforts and programs, engineering changes and other technical matters which are within the scope of MSC contractual direction will be issued over the signature of the Gemini Program Manager or his authorized representative and will be processed to the SSD GAPO. In no case will such instructions be processed directly to associate contractors under the cognizance of SSD.

4.3.3 Increase in Scope. Any GPO technical direction which increases the scope of MSC contractual direction to SSD or which alters the terms and conditions thereof will be directed in writing by the MSC Contracting Officer and processed as a Purchase Request Amendment. Any technical direction to associate contractors by the SSD, whether or not within the technical scope of existing contracts, which will result in additional program costs in excess of $50,000, shall require GPO concurrence prior to the obligation of funds.

4.3.4 Technically Inadvisable. If the direction received from MSC is considered by SSD to be technically inadvisable, the SSD GAPO will, prior to implementation, submit technical arguments and alternate proposals to GPO, usually at GPO coordination meetings. The GPO decision in such cases will be authoritative and will be confirmed in writing by the Gemini Program Manager.

4.4 Funding and Fiscal Reporting.

4.4.1 Financial Plans and Budget Estimates. The SSD GAPO will prepare a semi-annual financial plan and budget estimate for submission to GPO in accordance with MSC requirements, contained in the applicable Statement of Work. Further, GAPO will respond appropriately to supplementary MSC directives. Periodic review and adjustment of the financial plan and budget estimate will be accomplished by GAPO upon request of the GPO or as required by program changes.

4.4.2 Funding by NASA. MSC will allocate funds for SSD support of the GAATVS Program by NASA Defense Purchase Requests and Amendments thereto. The allocation of funding increments will be substantially in accordance with the time phased requirements reflected in the financial plan and budget estimate prepared by the SSD GAPO. It shall be the objective of MSC to provide increments adequate for support of the GAATVS Program for a period of not less than one fiscal quarter and to process the applicable funding documents in a timely manner to assure the arrival of such documents at SSD at least thirty and preferably 45 days prior to the beginning of that quarter.

4.4.3 Fund Exhaustion. The SSD GAPO will advise MSC whenever the funds obligated by SSD equal or exceed 80 percent of the amount shown on the face of the applicable Purchase Request as amended. When the requirement for funds exceeds that shown in the SSD financial plan or when the funding provided by MSC is inadequate for support through a full fiscal quarter, the GAPO will provide to MSC an estimate of the date when the available funding will be exhausted. It shall be the objective of SSD GAPO to advise MSC of new funding requirements 60 days prior to the need date. The GAPO will at that time request MSC to obligate additional funds to the applicable Purchase Request as necessary to maintain program continuity. It is understood and agreed that MSC is not required to obligate additional funds to the Purchase Request, nor is SSD obligated to provide support of the GAATVS Program beyond that period of time for which funds are available for performance.

4.4.4 Funding Obligation to Associate Contractors. Funds obligated to SSD by Purchase Requests and Amendments thereto will be futher allocated and obligated to the various SSD associate contractors or SSD cost elements at the discretion of the SSD Program Managers responsible for providing the supplies and/or services specified in the NASA DOD Purchase Request. This discretion of the SSD Program Managers will not include authority to allocate funds for other than the specific supplies and/or services designated in the Purchase Requests.

4.4.5 Status Reports by AFSSD. The SSD GAPO will provide fiscal, schedule and technical progress reports to GPO in accordance with the requirements contained in the applicable Statement of Work.

4.5 Air Force Procurement.

4.5.1 Procurement Action. Procurement action necessary to fulfill the requirements specified in the applicable NASA Defense Purchase Requests will be effected by SSD at the direction of the SSD Program Managers responsible for providing the supplies and/or services specified in the Purchase Requests. Procurement will be accomplished in accordance with the Armed Services Procurement Regulations (ASPR) and such other Air Force instructions, regulations and directives affecting SSD procurement activities.

4.5.2 Statutory Provisions and Clauses. Statutory provisions and other contractual clauses desired by MSC will be employed to the maximum extent practicable in those contracts initiated for and funded by NASA MSC.

4.5.3 Contractual Negotiations. The MSC GPO may designate representatives to observe statement of work and contractual negotiations pertaining to those contracts and/or contract modifications initiated for and funded by NASA MSC.

4.5.4 Contractual Documents and Directives. Information copies of all contractual documents, directives and instructions pertaining to the contracts and/or contract modifications initiated for and funded by NASA MSC will be provided by the SSD GAPO to the MSC GPO, the MSC Contracting Officer and, when applicable, to the MSC GPO representative stationed at the SSD contractor's facilities.

5.0 DETAILED RESPONSIBILITIES.

5.1 NASA-DOD Agreement. The NASA-DOD Operational and Management Plan for the Gemini Program, dated December 29, 1961, which was made the basis of a formal agreement by R. C. Seamans, Jr. and John H. Rubel on January 29, 1962, establishes among other things the following pertinent responsibilities:

5.1.1 NASA Responsibility. Overall management, planning, direction, system engineering, and operation of the Gemini Program is the responsibility of NASA.

5.1.2 Technical Authority. Final technical authority for the Program lies with the GPO, and final resolution of areas of technical disagreement between the SSD and MSC is with NASA.

5.1.3 AFSSD Responsibility. The NASA-DOD agreement states that although wide-spread authority is assigned to NASA, the GPO is a management group and that the actual development will be performed by other groups. The agreement, in part, establishes the following DOD (SSD) responsibilities:

5.1.3.1 Contractor to NASA. AFSSD will act as a contractor to NASA to procure the Atlas and Agena vehicles to be used in the Gemini rendezvous missions.

5.1.3.2 System Integration. AFSSD will provide Atlas/Agena systems integration.

5.1.3.3 Day-to-day Technical Direction. Within overall guidelines and criteria provided by NASA, day-to-day technical direction of the SSD associate contractors will be accomplished by AFSSD. SSD will keep GPO informed of this direction, usually by forwarding GPO copies of the action directive.

5.1.3.4 Launch Supervision. AFSSD will provide technical supervision, under NASA Operations Director, for the launch of the Atlas/Agena vehicles.

5.2 Supplemental Responsibilities. The following responsibilities are expanded and delineated in the following paragraphs:

a. Planning and coordination

b. GATV development and GAATV systems integration

c. Prelaunch activities at Cape Kennedy

d. Launch operations at Cape Kennedy.

e. Data reduction

f. AFETR Launch Complex 14

g. Title to equipment.

5.2.1 Planning and Coordination.

5.2.1.1 MSC GPO.

5.2.1.1.1 Direction and Funding. The MSC GPO has the responsibility to provide the SSD GAPO with appropriate program requirements, technical direction and funding necessary to accomplish the SSD responsibilities for the GAATVS.

5.2.1.1.2 Liaison. The GPO may assign limited numbers of personnel to perform liaison duties at SSD and at certain associate contractor plants having contracts and/or contract modifications initiated for and funded by NASA MSC for the GAATV program. The liaison links between GPO and the associate contractors will be utilized to expedite the exchange of information only. GPO directives, instructions and recommendations will be channeled through the SSD GAPO.

5.2.1.2 AFSSD.

5.2.1.2.1 Program Management. The SSD has the responsibility to provide adequate program management, procurement action, and technical direction necessary to accomplish the SSD responsibilities for the GAATVS.

5.2.1.2.2 Coordinate Activities. The SSD GAPO will coordinate all activities of other Air Force elements supporting the GAATVS.

5.2.1.2.3 Associate Contractors. The SSD GAPO has the responsibility for management and technical direction of the GATV associate contractors, except the associate contractor for the TDA.

5.2.1.2.4 Monthly Management Meetings. The SSD GAPO will conduct monthly management level meetings and periodic technical reviews with the associate contractor responsible for GATV development and integration of the GAATV. GPO may designate representatives to attend and participate in the proceedings of these meetings.

5.2.1.2.5 Coordination Meeting Participation. The GAPO will coordinate the activities of SSD in providing qualified representatives of SSD and its associate contractors to participate in the coordination meeting and panels established by MSC.

5.2.1.2.6 Technical Status Reports. The SSD GAPO will prepare or direct preparation of technical status reports on special subjects upon the request of GPO. Periodic GATV Program status and progress reports specified in the NASA - Defense Purchase Request will be provided through the associate contractors.

5.2.2 GATV Development and GAATV Systems Integration.

5.2.2.1 MSC GPO.

5.2.2.1.1 Overall Responsibility. The NASA MSC has the overall responsibility and authority for acquisition and systems integration for the Gemini Program. Acquisition, with the exception of the TDA, and systems integration of the GAATV is the delegated responsibility of the SSD GAPO. Responsibility for the Gemini Spacecraft/GAT and the GAT/ground network systems integration will be retained by MSC.

5.2.2.1.2 Funding and Authority. The MSC GPO has the responsibility and authority to provide the SSD GAPO with clearly defined performance requirements, adequate funding and authority as GAATV system integrator.

5.2.2.1.3 Acquisition of TDA. The MSC GPO has the responsibility and authority for acquisition of the TDA which will be provided to SSD as Government Furnished Equipment (GFE). The MSC GPO is responsible for assuring that the TDA furnished to SSD meets the interface design criteria provided by SSD, and that the TDA has the performance capability required for accomplishment of mission objectives.

5.2.2.1.4 Interface Specifications and Control Document. Definition of the interfaces between the Gemini Spacecraft, TDA, Gemini Agena, and the shroud is the responsibility of GPO. The previously mentioned Interface Control Panel has been assigned the task of defining this interface and the previously mentioned document, ISCD-2, has been issued by NASA to accomplish this definition and to control the interface. Agreements by all agencies with this document attest to the fact that the defined interface is compatible and will work satisfactorily.

5.2.2.2 AFSSD.

5.2.2.2.1 Performance Responsibility. The AFSSD has a responsibility to the GPO to develop and provide a Gemini Agena which, in conjunction with a NASA furnished TDA, can accomplish the required mission objectives.

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5.2.2.2 AFSSD.

5.2.2.2.1 Performance Responsibility. The AFSSD has a responsibility to the GPO to develop and provide a Gemini Agena which, in conjunction with a NASA furnished TDA, can accomplish the required mission objectives.

3. Insuring the stability and control of the docked combination of the dormant Gemini Spacecraft and the GAT. Consequently, studies, analyses, and design necessary to accomplish this are part of the SSD responsibilities. GPO in turn, is required to furnish SSD with the necessary pertinent information concerning the TDA and the Gemini Spacecraft. SSD is required to provide the GPO with the results of studies, analyses, and tests so that the effects of Gemini Agena attitude control on the TDA and Gemini Spacecraft can be comprehensively appreciated and considered for approval.

5.2.2.2.4 Contractor Cooperation. Insuring complete cooperation by the SSD contractor, LMSC,. with the NASA contractor, MAC, to the degree necessary for completion of the MSC systems integration functions is the responsibility of the SSD GAPO.

5.2.2.2.5 Development Testing. SSD has the responsibility for the necessary development testing of the GATV at LMSC. GPO is responsible for providing MAC support for these tests as necessary. To allow maximum advantage to be gained from these tests, SSD is responsible for supporting MAC TDA test requirements, as directed by GPO. Appropriate MSC personnel, as approved by GPO, will participate, as required, in a limited manner in the review of test plans and testing at LMSC. This participation will be of an observing, monitoring, and reviewing nature.

5.2.2.2.6 Acceptance Testing. The GATV acceptance testing is the responsibility of SSD. In the manner explained in the development testing paragraph above, MSC will participate in the acceptance testing carried out at LMSC. Close liaison between MSC representatives and SSD is necessary in order to preclude, as much as possible, modification or rework at AFETR. It is required that SSD provide the GPO with detailed plans for the acceptance testing of GATV well in advance of the first acceptance so that MSC participation can be adequately planned. Details are to be provided GPO on the organization and staffing of the government acceptance team and the plan which will be utilized in the vehicle acceptance and any other inspections or tests which may be associated with the acceptance of the vehicle.

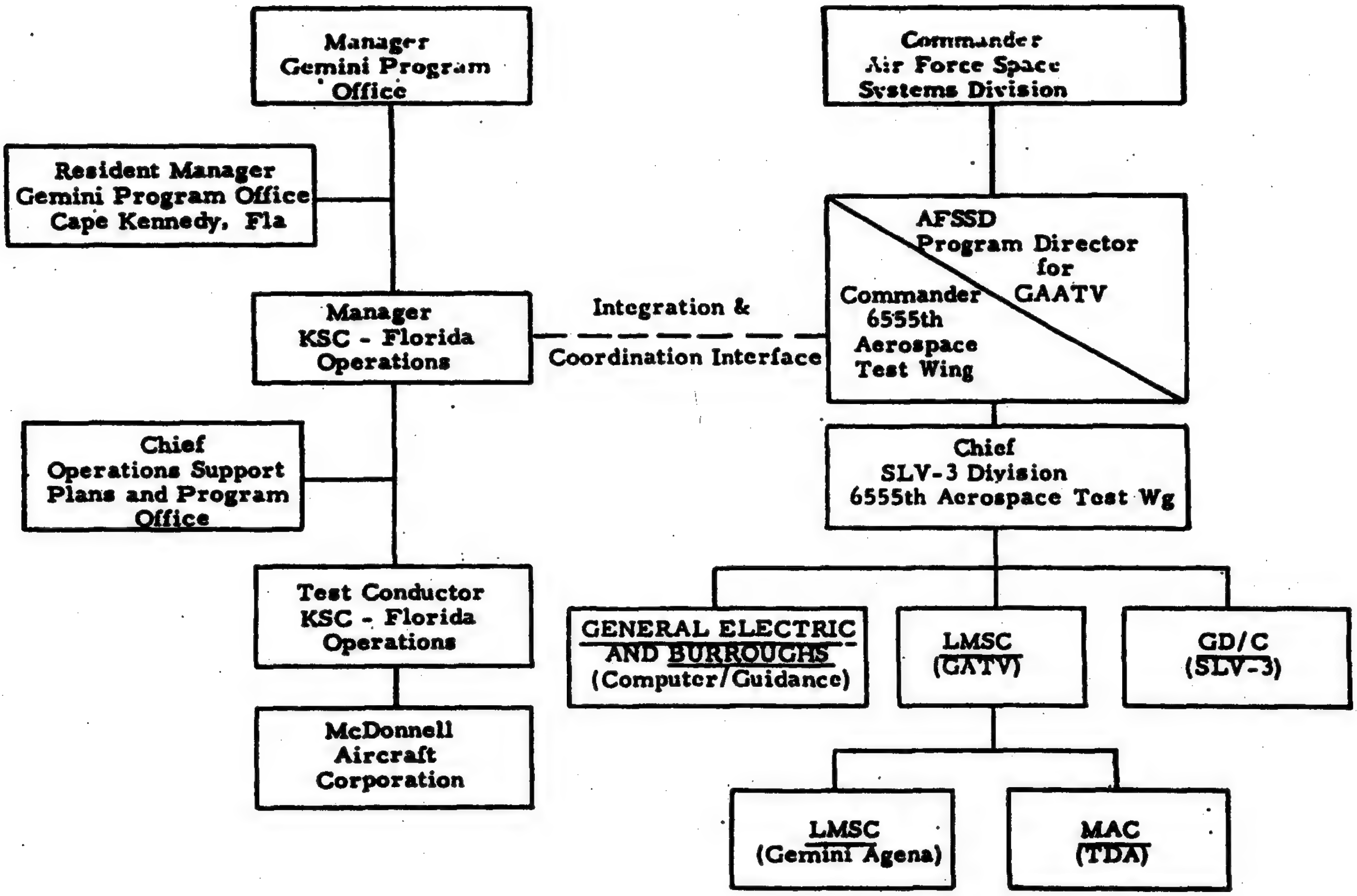

Figure 2. Prelaunch Organization Chart

requirements for the checkout of the mated TDA shall be the responsibility of MSC/MAC. MAC is responsible for all work, maintenance and servicing of the MAC supplied portion of the GATV. MAC shall have a coordinator who reports to KSC-FO, and who will be present for all testing of the TDA. LMSC procedures for testing the Gemini Agena and TDA jointly and in one test shall be reviewed and explicitly approved by an KSC-FO/ATW/MAC/LMSC interface testing committee.

5.2.3.4 Prelaunch Review. In addition to informal day-by-day status reviews of the SLV-3 and the GATV, it is necessary to have several formal reviews prior to launch. SSD has the responsibility at these reviews to report to NASA the detailed status and condition of the GAATV systems with respect to control of GAATV and mission success. The formal reviews delineated in the following subparagraphs are required:

5.2.3.4.1 Plan X Data Review. A formal review for NASA will be conducted approximately 5 days after completion of Plan X. These reviews are to evaluate the RF characteristics of the GAT and the spacecraft during a simulated mission.

5.2.3.4.2 Flight Readiness Review. A formal review for NASA will be conducted approximately 15 days prior to the scheduled launch to evaluate the readiness of the vehicles to achieve all mission objectives. This review is conducted to evaluate all waivers, deviations, modifications, discrepancies, and all work accomplished on the vehicles at Cape Kennedy. The review will place particular emphasis on items which may affect flight safety, reliability and adequacy of operation.

5.2.3.4.3 Mission Review. A formal review for NASA will be conducted approximately 2 days prior to launch for evaluation of mission readiness and integration of all vehicles, communication networks, range stations, recovery forces, weather forecasts, and launch complex operations.

5.2.3.4.4 Flight Safety Review. A SSD formal review for NASA and representatives will be conducted one day prior to launch to present the launch vehicles status. Upon completion of the review, the NASA Flight Director will approve the vehicles for launch.

5.2.3.4.5 AFSSD Reviews. It is required that NASA representatives observe similar SSD formal reviews held prior to the above specified reviews.

5.2.3.5 Integrated Work Plan. GPO has the responsibility to assure the establishment of a Gemini Program integrated prelaunch activities work plan. The details of the prelaunch activities work plan will be accomplished by KSC-FO and 6555th ATW.

5.2.3.6 Integrated Countdown. NASA has the responsibility of creating an integrated countdown. GPO will furnish the ground rules to NASA personnel at AFETR, and they will originate an integrated countdown plan for GPO approval.

5.2.4 Launch Operations at Cape Kennedy.

5.2.4.1 Lines of Authority. The responsibilities for this portion of the operation are delineated in the NASA-DOD agreement of December 29, 1961. However, for completeness, the organization and lines of authority for launch are shown in Figure No. 3.

5.2.4.2 Launch. SSD has the responsibility to execute launch of the GAATV and assure GAT attainment of orbit. This responsibility terminates upon completion of the last Agena ascent timer function. MSC flight controllers will monitor the status of the GAT systems during countdown and ascent into orbit, as well as during orbital operations. MSC flight controllers will be in control of the GAT during orbital operations.

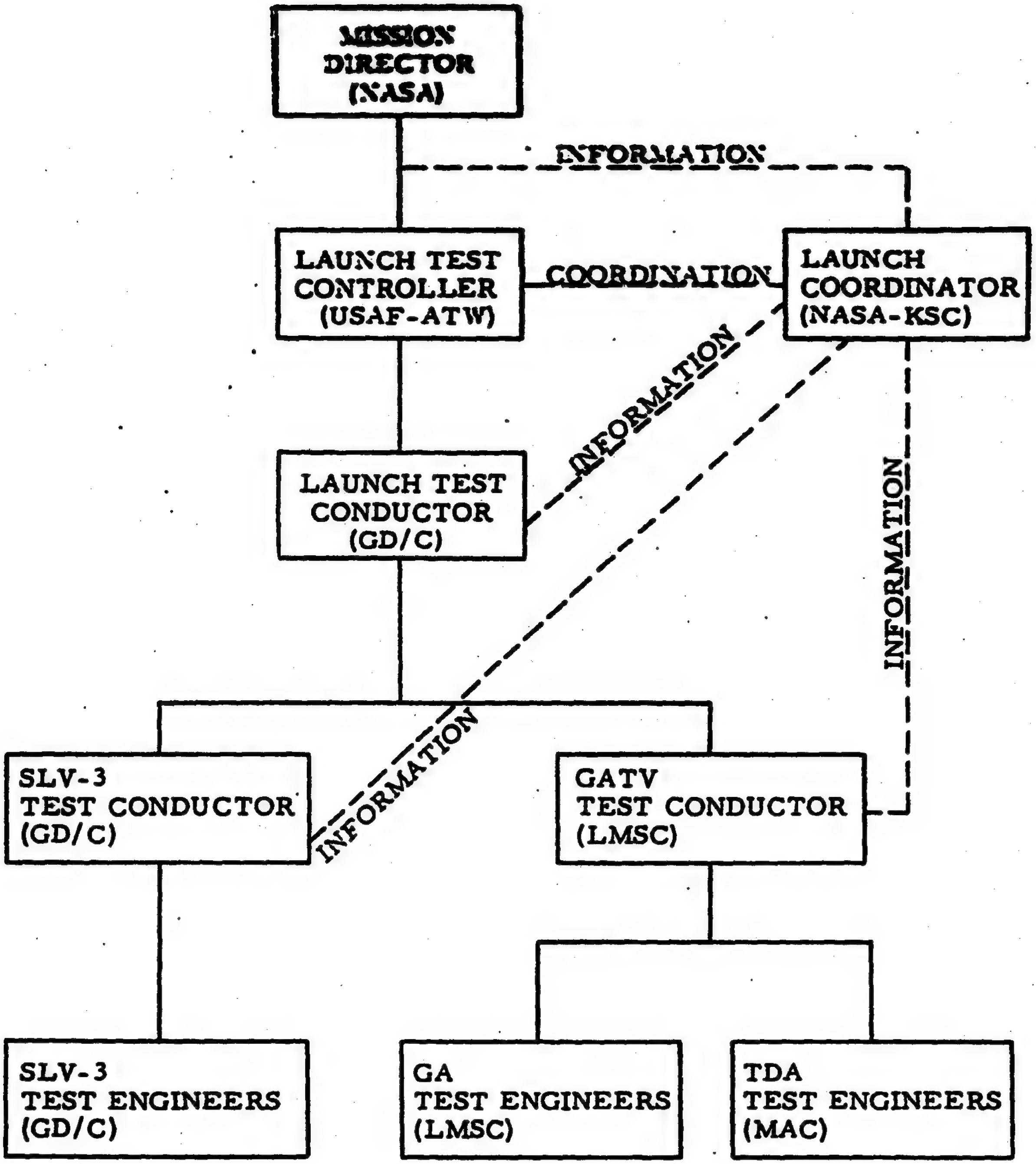
MISSION DIRECTOR (NASA)
INFORMATION
LAUNCH TEST CONTROLLER (USAF-ATW)
COORDINATION
LAUNCH COORDINATOR (NASA-KSC)
INFORMATION
LAUNCH TEST CONDUCTOR (GD/C)
INFORMATION
INFORMATION
SLV-3 TEST CONDUCTOR (GD/C)
GATV TEST CONDUCTOR (LMSC)
SLV-3 TEST ENGINEERS (GD/C)
GA TEST ENGINEERS (LMSC)
TDA TEST ENGINEERS (MAC)

Figure 3. Launch Organization Chart

5.2.5 Data Reduction

5.2.5.1 Preflight Data. The SSD GAPO has the responsibility for the design and preflight checkout data reduction and analysis for the GAATV (less the TDA). The reduction of preflight checkout data for the TDA shall be the responsibility of SSD. The analysis of preflight and postflight TDA data will be provided to SSD by MSC GPO.

5.2.5.2 Flight Data. The SSD or its associate contractor shall submit flight data reduction requirements, necessary for postflight analysis and evaluation of the GAATV, to the MSC GPO for each flight.

5.2.5.2.1 The analysis of flight data for the GATV and the reduction and analysis of flight data for the SLV-3 will be the responsibility of the SSD within the framework of the applicable Gemini Program Mission Evaluation and Reporting Plan and as necessary for SSD evaluation of contractor performance.

5.2.5.2.2 The reduction and analysis of TDA flight data will be accomplished through MSC GPO and provided to SSD.

5.2.5.2.3 Quick look ascent data reduction for the GATV will be provided to both SSD and MSC by the appropriate AFETR and SSD facilities. The reduction of flight data for the GAT will be accomplished through MSC GPO and provided to SSD. Reduction of GAT flight data by SSD or its associate contractor shall be limited to: (a) specific flight data reduction task(s) delineated by the MSC GPO for implementation by SSD, (b) that reduction necessary to support GAT design and operational analysis which cannot be defined prior to flight or the need for which results from evaluation of flight results, (c) reduction as is required to analyze or resolve problem areas which the SSD is requested to investigate by MSC GPO.

5.2.5.2.4 The trajectory data will be reduced and provided by AFETR.

5.2.5.3 Post-mission Reporting and Evaluation Activities. The responsibility for preparing the Gemini Program Mission Evaluation Reports rests with the MSC. The detailed operations and procedures to be followed in preparation of the report, as recorded in the data evaluation plan released prior to each flight, will be established by MSC GPO.

5.2.5.3.1 GAATV Performance Evaluation. SSD will have responsibility for the preparation of the GAATV sections of the report, and will assign personnel to the Mission Evaluation Team. MSC GPO technical personnel will work with SSD personnel in this effort. All personnel assigned to evaluate this mission will operate as a coordinated team and the responsible person from the SSD element is required to work within the framework of the Mission Evaluation Team until all areas of the report have been completed and reviewed.

5.2.6 AFETR Launch Complex 14.

5.2.6.1 Complex 14 Modifications. The USAF will initially provide and fund the AFETR Launch Complex 14 with launch facilities and equipment necessary for servicing checkout and launch of the GAATV in accordance with the approved launch schedule, except for certain items of AGE which are peculiar to the Gemini Program to be provided by MSC GPO.

5.2.6.2. Subsequent Funding. Subsequent to AFETR Launch Complex 14 Agena vehicle on stand (VOS) capability date and Booster FACT date, GAATVS launch services will be the responsibility of MSC GPO. SSD will notify GPO of these dates.

5.2.6.3 Major Catastrophe. Should a major catastrophe occur to AFETR Launch Complex 14 during use by the Gemini Program, NASA will provide refurbishment or replacement of the facility and AGE as required by Air Force.

5.2.6.4 Common Usage Equipment. Certain equipment and facilities now in being at AFETR, such as Atlas hangars, Agena hangar E, General Electric Ground Guidance Station, and Burroughs Computer, will be subject to common usage between USAF and NASA.

5.2.6.5 Subsequent AGE. The design of the USAF provided AGE for AFETR Launch Complex 14 was finalized on March 15, 1964, due to the schedule established for development testing of the first article GATV and the activation of the complex. Funding for subsequent AGE design changes or modifications if necessitated by GATV design changes will be the responsibility of MSC GPO.

5.2.7 Title to Equipment.

5.2.7.1 Non-expendable equipment having a unit cost in excess of $100 for which total reimbursement is made from NASA funds shall remain in NASA. All such items shall be identified and marked NASA property. Records shall be maintained to the extent that periodic inventory reports can be submitted to NASA upon request. Listing of all excess, residual and termination inventories shall be submitted to the NASA MSC for disposition instruction at the completion of the GAATV Program.

5.2.7.2 USAF Equipment. Title to items of USAF equipment which have been loaned to NASA, either as is or modified by use of NASA funds, for the GAATV Program shall remain in the USAF and shall be returned to USAF custody at the completion of the GAATV Program. Items of equipment, such as the C-10 Agena system checkout complex modified by NASA funds, for which NASA desires to obtain title to or retain control of beyond GAATVS requirements, will be referred to the appropriate NASA and DOD Headquarters for final resolution.

6.0 AUTHORIZATION AND AMENDMENT.

6.1 Amendment of Agreement. It is agreed by both NASA MSC and the AFSSD that this Management and Responsibilities Agreement may be amended by renegotiation at any time upon request of either agency.

6.2 Effective Date. This Agreement is effective upon signature below.

John B. Hudson
JOHN B. HUDSON
Colonel, USAF
Deputy for Launch Vehicles, AFSSD
Date 29 MAR 1965

Charles W. Mathews
CHARLES W. MATHEWS
Manager, Gemini Program
NASA MSC
Date APR 9 1965

Ben I. Funk
BEN I. FUNK
Major General, USAF
Commander, AFSSD
Date 31 MAR 1965

Robert R. Gilruth
ROBERT R. GILRUTH
Director
NASA MSC
Date APR 9 1965

[illegible]GA [illegible] March 1965

MEMORANDUM FOR RECORD

SUBJECT: Biosatellite Program -- Call from Cols Pickering and Swan of AMD

1. Reference is made to my memorandum for record, 5 Mar 65, subject: Biosatellite Program, of a meeting I had with Lt Col Swan of AMD on 5 Mar. As a follow-up of this meeting I received a call from Lt Col Swan with Col John Pickering (Deputy for Research and Development, AMD) also on the line. Swan stated that after his return to AMD he discussed with Pickering the exchange of comments during our 5 Mar meeting and also the position Gen Cooper had taken with regard to SSD's responsibility in the biosatellite program and Pickering is perfectly agreeable to the latter. Swan and Pickering also discussed this matter with Col Townsend, AMD Vice Commander, as well as Gen Bedwell; they are also both in complete agreement with the position Gen Cooper has taken. I advised that Gen Funk has subsequently seen my memo for record indicating the position taken by Gen Cooper and Gen Funk also agrees. I then stated that our next course of action is to get a buy-off from Hq AFSC and advised that SSD is presently preparing a letter stating SSD's position and advised that I would send a copy of our letter to Col Pickering.

2. With regard to ADO 35, I told Col Pickering and Col Swan that I had just this morning discussed this with Col Rochte in some detail and that Rochte is preparing our comments. Hopefully, we can get our comments on the way by the end of this week. Further, I stated that the start of Phase II would undoubtedly be sometime after 1 July based on my previous conversation with Col Swan. I mentioned also that in my conversation with Col Rochte this morning, I understand that this is going to require a considerable amount of coordination with NASA and that this would undoubtedly take time. They agreed and added that they are scheduled to meet with NASA in April.

3. I explained that our problem here is one of being short across the board and we do not have any bio capability in the organization except people under MOL and these people are reluctant to get into this

particular program for obvious reasons. Pickering and Swan realize this and stated that they would prefer that their MOL people stay with MOL and not get overburdened. I stated that we have to build up a capability within SSD to handle SSD's responsibilities in connection with the Biosatellite program but that it appeared we had some leeway time-wise. They agreed and stated that the finer details of this capability could be acquired after we get approval for the program.

4. Col Pickering also advised that Gen Ferguson has asked for a briefing a week from Tuesday (presumably 16 Mar) on the Biosatellite program and Col Swan plans to go in and work with his counterpart in Gen Ferguson's office. He promised to furnish to SSD any feedback from this briefing. They added that it was not necessary that they receive our comments on the ADO 35 before this briefing but stated that the sooner they get our comments on the ADO, the sooner they can go into headquarters for approval.

5. With regard to the Advanced Development Plan, AMD advised that they would expect to pick this up as the lead division for preparing and processing it.

J. L. HAMILTON
Colonel, USAF
Asst for Staff Support

Copy to:
SSL

HEADQUARTERS
SPACE SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
LOS ANGELES AIR FORCE STATION
Air Force Unit Post Office, Los Angeles, California 90045

MEMORANDUM FOR: GENERAL FUNK 2 April 1965
THRU: GENERAL COOPER

SUBJECT: Advanced Life Support Capsule

1. On 23 October 1964, General Cooper had a discussion with Dr. Heatherington, Hq AFSC, concerning SSD support of an Advanced Life Support Capsule. As a result of this conversation, and subsequent verbal inputs that we received, Gen Cooper asked me to get with Col Hudson and Col Brady to try to determine which office, if either, might be at least the initial SSD focal point. After discussions with Colonels Brady and Hudson, I asked Colonel Hudson to accept the job of being the initial contact point for the program with the view that when the program actually got underway, we would probably designate another SSD office.. Colonel Brady had strong reservations that his office, being a manned space effort, should not become involved with a bio program involving primates.

2. Subsequently, Colonels Hudson and Nielsen, and Major Jones, all of SSV, attended a meeting at Hq AFSC on the Biosatellite Program. As a result of this meeting, we received a letter of 17 November 1964, subject as above, from Col Marschner which indicated that SSD was to be designated as the lead division and program manager of Phases II and III with the necessary technical support to be provided by AMD (Tab 1). General Cooper questioned the SSD role. In his view, which he subsequently communicated to Gen Cody, the SSD responsibility should be limited to the procurement and launch of the booster and standard Agena, Agena interface with the payload, and assistance to Payload Acquisitions Office (AMD) as to spacecraft design criteria. You indicated that you agreed with this position (Tab 2).

3. Meanwhile, I was contacted by Colonels Pickering and Swann. I indicated the SSD position to them and they subsequently informally indicated AMD's concurrence with this position (Tab 3).

4. Previously, I had asked SSL to make a determination of the proper SSD office to manage the SSD portion of the Biosatellite Program (Tab 4). They boiled the selection down to SSU and SSH. Over Col Cushman's objection, they recommended SSU on the basis that they were organized to handle programs which involve interface with SSV, the contractor, and other agencies.

[illegible]

5. Early in March, you received a letter from Gen Bedwell in which he stated that it was his understanding that SSD would assume the lead division responsibility for the Advanced Development portion of the Biosatellite Program (Tab 5). He mentioned that Major Jones had been the SSD point of contact; and that it was his intention to furnish to you, on a TDY basis, the necessary bioastronautics support until the Advanced Development Program had been approved and funded, at which time he suggested that you and he get together and discuss a more permanent arrangement.

6. We also received a copy of Advanced Development Objective #35 which was transmitted to us by AMD for comment. I subsequently referred this to Col Rochte for comment. Additionally, in order to have some qualified bio-med comments on the ADO, I asked Gen Bleymaier if he would have his people comment. This he agreed to do. I anticipate that they will have an answer up for signature in the near future.

7. On 23 March 1965, Gen Cooper signed out a letter, subject as above, to Gen Cody, restating the SSD position which he had verbally discussed with him and requesting that Hq AFSC issue clarifying instructions in conformance with this position (Tab 6).

8. We received the Advanced Development Program from AMD by letter dated 23 March 1965 and this Advanced Development Program does, in fact, support the SSD position (Tab 7).

9. I have had several discussions with Gen Bleymaier on this subject and in view of the type data that will be obtained in the AMD Program, he considers it important that his office be the focal point for the program. I recommend that his office be designated as the focal point.

10. I understand that there has been some opposition in the Pentagon to the AMD Program. It is a costly program and there is some question to whether this should be done by the Air Force or NASA. It appears that AMD may be a long way from obtaining formal program approval for Phases II and III.

11. I recommend you sign the attached letter to Gen Bedwell, which should complete the action with regard to his 25 February letter to you.

JLH

J. L. HAMILTON
Colonel, USAF
Asst for Staff Support

1 Atch
Ltr to Gen Bedwell

214

SSK

(U) Request for Determination and Findings Pursuant to AFPI 3-214

AFSC (SCK-3)
Andrews AFB
Wash DC 20331

Hq USAF (AFSPP-CA)
Wash DC 20330
IN TURN

1. (U) A Secretarial Class Determination and Findings is requested authorizing the negotiation of contracts, pursuant to Title 10 U.S. Code, Section 2304 (a)(14).

2. (C) Justification for negotiation of the proposed procurements is set forth below, in accordance with the format contained in Air Force Procurement Instructions 3-214.50.

Category 1 - Legal Sufficiency

a. The procurements contemplated by this request are as follows:

(1) SS-01A, S-01B and S-01C, all models of the Agena Space Vehicle hereinafter referred to collectively as the S-01 and the YLR 81-BA-11 and YLR 81-BA-13 S-01 Primary Propulsion Engine. A contract was awarded in FY 62 for long leadtime materials necessary to achieve a production capability, beginning in FY 62 for the complete S-01 Space Vehicles. Follow-on contracts were awarded for long lead-time items required for additional S-01 Space Vehicles. D&Fs authorizing negotiations were D&F Numbers 62-14c-13 and 64-14c-1. The proposed FY 66 procurements will likewise provide for long lead-time materials to permit continuous production through CY 67. The S-01 and the Primary Propulsion Engine will be produced at a rate of 3 to 4 vehicles per month depending upon the requirements and DDR&E direction.

(2) Optional equipment to be used by a number of space programs, depending upon their individual missions. The design, qualification and initial buy of optional equipments were accomplished in FY 62. The FY 66 requirements will include the optionals determined necessary to accompany vehicles delivered in CY 67.

(3) Spare parts and logistics support in consonance with the vehicles and equipment identified above. These items were obtained for

GROUP 4
[illegible]

vehicles produced in FY 63, FY 64 and FY 65. The spares contemplated for FY 66 will likewise support the vehicles procured and delivered in that period, most of which are peculiar to the S-01 and are not of a type which can be obtained in the open market.

(4) Component and Spares Improvement, Repair and Reliability Programs, including studies and design, which are to be procured on a rate-of-effort basis. A similar program was obtained in FY 63, FY 64 and FY 65, with requirements generated from the results of flight tests and other sources. The end purpose of the Component and Spares Improvement, Repair and Reliability Programs are to maintain and improve the quality and reliability of the S-01 vehicles in order to satisfy the requirements of the user satellite programs.

b. The S-01 Space Vehicles are advancements of the Agena design. These space vehicles perform ascent and orbital missions within a space environment which demands an exceptional degree of component and system reliability, and demands the ability of all components to operate effectively with a number of satellite systems and associated ground equipment. The S-01 must satisfy the requirements of both an upper stage boost vehicle, and the more complex requirements of an orbital satellite with payload recovery capability. The S-01 must further be adaptable to the mission requirements of a number of space programs, and must therefore be designed with regard to an interface between the Thor, Atlas and Titan IIIX Space Boosters as a first stage; and the various satellite programs' payload. The S-01 is the basic ascent and orbital vehicle for programs sponsored by not only the Air Force, but also the NASA, AEC and ARPA.

c. The procurement program for S-01 FY 66 is estimated as follows:

Vehicles	$ 24,800,000
Primary Propulsion Engines	5,400,000
Spares	1,700,000
Optional Equipment	1,500,000
Logistic Support & Storage	800,000
General Support	3,500,000
Advanced Development	2,500,000
Production Propellants, Factory Test Equipment	500,000
Total	$ 40,700,000

vehicles produced in FY 63, FY 64 and FY 65. The spares contemplated for FY 66 will likewise support the vehicles procured and delivered in that period, most of which are peculiar to the S-01 and are not of a type which can be obtained in the open market.

(4) Component and Spares Improvement, Repair and Reliability Programs, including studies and design, which are to be procured on a rate-of-effort basis. A similar program was obtained in FY 63, FY 64 and FY 65, with requirements generated from the results of flight tests and other sources. The end purpose of the Component and Spares Improvement, Repair and Reliability Programs are to maintain and improve the quality and reliability of the S-01 vehicles in order to satisfy the requirements of the user satellite programs.

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General Support	3,500,000
Advanced Development	2,500,000
Production Propellants, Factory Test Equipment	500,000
Total	$ 40,700,000

[illegible]

(1) The major categories of work required to prepare for production by a contractor other than Lockheed Missiles and Space Company and Bell Aerosystems Company would include the creation of considerable production facilities of exceptionally complex equipment for the reliability required. It would include design and fabrication of tooling according to the production methods of any company which might be selected; it would include the recruitment and training of production engineers, technicians, manufacturing personnel, quality control personnel etc. Additionally, this would include the requirement for suitable types of management.

(2) Assuming that an otherwise qualified producer could be found, and that he could devise production methods and obtain production equipment, as well as tooling, it would be necessary that a prototype be fabricated and tested prior to commencement of production. Experience has shown that components, when combined as a system, may function perfectly under ground test conditions, but fail in flight under environmental conditions found in space. Hence, it would be required that one or more prototypes be flown with extensive telemetry instrumentation to diagnose the effectiveness of the system and to identify the cause of failures. In short, the cost of obtaining confidence in a new supplier's product would amount to a development program.

(3) In view of the importance of competitive procurement, a study was made by the Air Force for the purpose of ascertaining the time required for another contractor to produce this vehicle. This study revealed that a minimum of 26 months preparation time would be necessary providing no unusual technical difficulties were encountered. This study also assumed that adequate manufacturing information and data could be obtained from the Lockheed Missiles and Space Company and Bell Aerosystems Company.

Category 2 - History of Previous Procurement for end Items and Current and Future Procurement Plans

a. The present producer of the S-01, Lockheed Missiles and Space Company, was selected on a competitive basis by solicitation of industry, procurement of competitive research contracts, and award of the R&D contract. This competition was performed in accordance with established Air Force procedures utilizing a source selection board to determine the successful contractor.

b. The present producer of the Primary Propulsion Engines of the S-01, Bell Aerosystems Company, was selected as a subcontractor by Lockheed Missiles and Space Company in accordance with established procedures.

c. Any decision to establish competitive sources must recognize, not only the duplicate cost to the Government, but more importantly the effect of the time delay involved in preparation before any production could be expected. The state-of-the-art in the space field advances so rapidly that any design which is committed to production today will bear small resemblance to the design requirements of three years hence. The advancement of science and technology concerned with space activity over the past five years is a matter of common knowledge. A delay, approximating two to three years, would adversely affect the interests of the country.

d. The foregoing information obviously applies to any plan to split the current procurement into quantities which would permit obtaining a second source.

e. It is contemplated that the production aspects of the program will continue to be procured on a fixed price basis.

f. Procurement Background

(1) The Lockheed Missiles and Space Company developed the S-01 vehicles under several contracts, the first of which was awarded in October 1956. Several versions of this vehicle were produced under the Agena A and Agena B nomenclature. The Agena C version was not procured. The first contract for research, design development, and qualification of a standard S-01A configuration (Agena D) was awarded in August 1961. This contract also provided for the production of 12 units, design and qualification of optional equipment, and initiation of a component improvement program. To date, all of these units of the S-01 have been delivered and accepted by the Air Force. An additional 85 units were delivered in CY-1962, CY-1963 and CY-1964. Follow-on production contracts for the Agena have been awarded for 36 units with deliveries starting in January 1965, and the final delivery to be made in January 1967. The first S-01 contract provided for tooling and a capability to produce at the rate of five (5) units per month in anticipation of the contracts contemplated by this request. At the present time, there are known requirements for an additional 29 vehicles with a potential for considerably more than this quantity. Technical data which will ultimately serve as the basis for developing a procurement package is operationally accumulated concurrently and continually. The rapid improvement in the state-of-the-art requires day-to-day program adjustments. This instability in technology eliminates all possibility for scheduling the creation of procurement data suitable for competitive solicitation. Freezing the design of the S-01 for the sole purpose of establishing a competitive approach in procurement would be against the national interest.

(2) The Bell Aerosystems Company developed the S-01 Primary Propulsion Engine under several subcontracts with Lockheed Missiles and Space Company, the first of which was awarded in the last quarter of CY 1956. In general, the quantities, the pace set, and justification coincide with the remarks covering the S-01 above. Decision was made in CY 1964 to furnish the engine separately to Lockheed as GFE. The first contract was let with Bell in CY 1965. Contracts contemplated are follow-on in nature.

g. The following procurement plan, based on a desired contract placement date of 20 April 1966. is proposed for the S-01 and Primary Propulsion Engines:

CY 1965

April - Requirements submitted to AFSC

June - DDR&E direction for CY 1965 procurement
- D&F approval

July - Complete work statements

August - Issue RFPs

October - Receive Contractors' Proposals

November - ACO Cost Analysis Completed

December - Staff briefings and negotiation plans completed

CY 1966

January - Negotiations completed

February - Contract writing and initial SSD reviews completed

March - Contractors' signatures
- Final SSD reviews completed

April - AFSC approvals
- Distributions

The assumption is based on experienced past histories of procurements and the required contract placement date is as shown above.

h. No contractor Furnished Equipment is contemplated.

3. (U) This letter is classified CONFIDENTIAL since it reveals the Estimated FY-66 Program.

SIGNED

PAUL T. COOPER
Brigadier General, USAF
Vice Commander

1 atch
D&F - Authority to Negotiate
Contracts (U) 11 cys

DEPARTMENT OF THE AIR FORCE
DETERMINATIONS AND FINDINGS
AUTHORITY TO NEGOTIATE CONTRACT

1. This procurement will consist of one or more contracts for SS-01A, S-01B, SS-01B and S-01C, all models of the Agena Space Vehicle hereinafter referred to collectively as the S-01; Optional Equipment necessary to accompany vehicles, Component Improvement Studies and Design, Reliability Programs, certain Spare Parts, Procedural Data, Repair and Modification of Spare Parts and Components, and Storage requirements for the S-01 Vehicles; and YLR 81-BA-11 and YLR 81-BA-13 Rocket Engine, both models utilized by the S-01 Agena Space Vehicle, Optional Equipment necessary to accompany engines, Improvement Studies and Design; Initial Spare Parts, and Technical Support for S-01Primary Propulsion Engines. This is a follow-on to procurement actions originally placed through competition.

2. The authority herein granted to negotiate for spare parts is limited to those spare parts which are determined, not later than 90 days prior to the scheduled acceptance of the last article under contract, to be necessary to support the end items being procured under authority of this determination and findings and are not identical to parts previously procured by the Air Force on other than the contracts to which this determination and finding is applicable.

3. The S-01 Space Vehicles perform ascent and orbital missions with a space environment demanding an exceptional degree of component and system reliability and the ability of all components to operate effectively with a number of satellite systems. It must satisfy the requirements of both an upper stage boost vehicle and the more complex requirements of an orbital satellite with payload recovery capability. It must be designed with regard to an interface between the Thor, Atlas and Titan III Space Boosters, as a first stage; and an interface with various satellite payloads. These requirements reflect the technical and highly specialized nature of the S-01 Space Vehicles.

a. With respect to facilities:

(1) Both the Government and the Lockheed Missiles and Space Company have made substantial investments to achieve the capability to produce the S-01. The Government has invested approximately $26M for industrial facilities, special tooling and test equipment, and checkout complexes. Lockheed Missiles and Space Company has invested approximately $83M for industrial facilities, independent research, and the training of personnel. The Government would have to duplicate its investment of approximately $26M if these procurements were to be made from a source other than the one which is presently producing the items. Also, it would not be feasible or practical to furnish a new supplier with duplicate Government-furnished property, in that present producer is using all Government-furnished parts in performing on existing contracts that will not be completed until

[redacted]

(2) Both the Government and the Bell Aerosystems Company have made substantial investments to achieve the capability to produce the S-01. The Government has invested approximately $7.4M for industrial facilities, special tooling and test equipment, and checkout complexes. The Contractor has invested approximately $15.2M for industrial facilities; independent research; and the training of personnel. The Government would have to duplicate its investment of approximately $7.4M if this procurement were to be made from a source other than the one which is presently producing the items. Also, it would not be feasible or practical to furnish a new supplier with the Government-furnished property, in that present producer is using all the property in performing on an existing contract that will not be completed until October Calendar Year 1966.

b. The present suppliers have achieved the know-how and capabilities to produce this highly complex satellite vehicle over a period of approximately eight years. Another supplier would require at least 26 months of preparation time before the first prototype could be produced. Follow-on deliveries must commence not later than October 1966 to meet the schedules of the using satellite programs. The present sources can meet these schedules. New sources would not be able to deliver prior to April 1967, seriously affecting the U. S. Satellite Program.

4. Based on the findings above made, I hereby determine that the proposed procurement is for technical and special property requiring a substantial initial investment and an extended period of preparation for manufacture, and that formal advertising would result in additional cost to the Government by reason of duplication of investment, and might require duplication of preparation already made which would unduly delay procurement.

5. Upon the basis of the determinations and findings above, I hereby authorize the negotiation of contracts for this procurement pursuant to 10 U. S. C. 2304 (a)(14). This class determination shall remain in effect until 30 June 1966.

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HEADQUARTERS
SPACE SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
LOS ANGELES AIR FORCE STATION
Air Force Unit Post Office, Los Angeles, California [illegible]

29 J[illegible] 1965

REPLY TO
ATTN OF: [illegible]

SUBJECT: Request for Organization Change - Gemini Agena Division (SSVAT)

TO: AFSC (SCOO)

1. Request reorganization of the Gemini Agena Division (SSVAT) into the Gemini Target Vehicle Directorate (SSVT) effective FY 1/66. This proposed Gemini Target Vehicle Directorate will be organized according to the general principles set forth in AFSCM 375-3, dated 15 Jun 64. Attachment 1 shows the current Gemini Agena Division with functional statements. Attachment 2 shows the proposed Gemini Target Vehicle Directorate.

2. No increase in manpower will be needed for the reorganization. However, grade exchanges are requested. A Colonel for a Lt Colonel authorization, for Director, Gemini Target Vehicle Directorate. Two Lt Colonels for two Majors authorizations, one for Chief, Engineering Division, and one for Chief, Operations Division. Currently authorized Gemini Agena manpower will be augmented by seven spaces from within Deputy for Launch Vehicles. These seven spaces are in corresponding or similar functional areas which this reorganization is consolidating to create the Gemini Target Vehicle Directorate.

3. The present Gemini Agena program office organization structure abrogates the full authority of the Program Director. This has caused growing concern not only to the SSV Deputy, but to the NASA Manned Spacecraft Center (MSC) Program Director and to the Commander, SSD. They have voiced a firm desire to have the Gemini Agena Program Director have a consolidated organization over which he has direct management control.

4. Since September 1963, when the Gemini Agena Program Office was reduced from Directorate (SSMR) to Division status (SSVAT), the Program Director has experienced mounting difficulties in attempting to apply sound program management principles. While carrying full responsibility for managing the Program, he has not had the authority to fulfill these responsibilities; this situation being inherent to the SSVAT organization containing neither procurement, configuration control, nor engineering elements. The Program Management Concept Document (see Atch 3) attached to General Ritland's letter clearly indicates that the Gemini Target Program is considered to be a specific program (not part of the Agena Directorate program), to be managed separately in accordance with 375 series AF and AFSC publication delineating system management procedures as applicable. In March 1965,

[redacted]

5. With the first Gemini rendezvous mission scheduled for the 4th Quarter of CY 65 and with top level U. S. Government pressure on the NASA to advance rendezvous accomplishments, it is imperative that the Program Director be given an organization and authorization to respond quickly and effectively to changing schedules and hardware requirements from NASA.

6. In consonance with General Ritland's letter to General Funk, Subject: Management Concept for SSD Programs, 5 Apr 65 (see Atch 3), system management requirements have been reviewed for the Gemini Atlas Agena Target Vehicle Program. It is highly recommended that consideration be given at Hq AFSC to request approval from Hq USAF to establish a System Program Office for the Gemini Target Vehicle.

7. Attached are AFSC Forms 186, 186C and 186A-4 reflecting the above reorganization.

FOR THE COMMANDER

SIGNED

J. L. HAMILTON
Colonel, USAF
Asst for Staff Support

7 Atch
1. Current Organization (SSVAD)
2. Proposed Organization (SSVT)
3. Ltr, MSF, 5 Apr 65, Mgt Concept for SSD Programs
4. NASA/SSD Management and Responsibilities Agreement
5. AFSC Form 186
6. AFSC Form 186C
7. AFSC Form 186A-4

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HEADQUARTERS
SPACE SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
LOS ANGELES AIR FORCE STATION
Air Force Unit Post Office, Los Angeles, California 90045

REPLY TO ATTN OF: SSVA

SUBJECT: (U) Historical Report, 1 January 1965 - 30 June 1965

9 AUG 1965

TO: SSEH

1. (U) The Agena Directorate is responsible for the management and technical direction of contractor efforts for the definition, design, production, modification, storage, logistic support, test and launch support of the Agena space vehicle for all using programs. This includes certain engineering and procurement support to specified programs. The Directorate provides Aerospace Ground Equipment engineering support and facilities activation for all using programs and is responsible for the management and direction of the Agena launch services contracts for the Eastern and Western Test Ranges. The Directorate is also responsible for all program functions for the acquisition and launch of the Gemini Agena Target Vehicle. The Burner II Task Group, which was formally established within the Directorate during February 1965, functioned as a provisional staff office until June 1965 when it was organized as a separate Division within the Directorate. Col William C. Nielsen is the Agena Program Director and on 21 May 1965 Lt Col C. E. Riddle became Deputy Director, succeeding Lt Col R. K. Le Beck whose retirement is effective 30 Jul 65.

2. ~~(C)~~ Since 1 January 1965, 15 Agena vehicles (13 Agena D's) were launched successfully, bringing the total Agena flights to 169 (79 Agena D). As of 30 June, the last 25 successive launches were successful and the overall success ratio of the Agena D vehicle is over 92%

3. (U) Seven new contracts were issued during this period and two Letter Contracts were definitized. The total estimated value of the 43 active contracts now being managed is $450,000,000. One of the most significant events in the Directorate was implementation of the decision to procure Agena engines directly from Bell Aerosystems Co. The first buy is for fifty-five 8096 engines for Standard Agena and two 8247 engines for the Gemini Agena Target Vehicle. These engines will

DOWNGRADED AT [illegible] INTERVALS;
DECLAS[illegible] 12 YEARS.

be furnished to Lockheed Missiles and Space Company (LMSC) as Government Furnished Equipment (GFE) to support Letter Contract AF 04(695)-722 which covers procurement of 57 Agena vehicles. Letter Contract AF 04(695)-737 was definitized into two individual contracts for launch services at the Eastern Test Range and the Western Test Range. A Basic Ordering Agreement, AF 04(695)-569, which provides for individual cost reimbursement calls to perform engineering efforts on an incentive basis was issued with LMSC.

4. (U) At the request of Dr. Albert C. Hall, Deputy Director (Space) DDR&E, representatives of the Agena Directorate presented to Hq USAF, The Under Secretary of the Air Force, and Dr. Hall, the results of a study which outlined a number of possible improvements to the Agena vehicle. The improvements were primarily aimed at increasing the Agena on-orbit maneuvering and payload capabilities without major change to the Agena configuration envelope. The proposed improvements are being studied by DDR&E.

5. (U) The Directorate was involved in the evaluation of two major contractor proposals to upgrade the performance and reliability of the Agena vehicle. These proposals were the Agena Improvement Drive (AID) and the Agena Long-Range Improvement Drive (Phase II). The AID proposal was a three point program consisting of expanded Production Reliability Evaluation Program (PREP) testing, a review of current acceptance test specifications and procedures, and a component screening program. The Phase II proposal aimed at an increase in the orbital reliability of the Agena through major and minor hardware changes. Major changes included an Integrated Guidance Module, (IGM), simplified engine control circuitry, improved connectors and improved wiring. Both proposals were thoroughly evaluated by Agena Directorate and using program engineers, and those portions of the proposals which were technically desirable and economically feasible have been implemented. Other portions of the proposals required further study by the contractor.

6. (U) Significant improvements were realized in the Quality Assurance and Configuration Control Programs of the Agena prime contractor, Lockheed Missiles and Space Company (LMSC). This improvement was determined to be necessary primarily through problems encountered in the Gemini Agena Target Vehicle Program. Because of the difficulty encountered in resolving the problems, it was necessary to seek top management support (both AFSSD and LMSC) to arrive at acceptable solutions. Through meetings with Gen Funk, Mr. L. E. Root, president of LMSC, was convinced that problems did exist. He provided the high level management impetus necessary to cut through the procedural and contractual barriers which hampered effective performance by LMSC. As a result, in May 1965, a new LMSC Quality Assurance Program Plan, effective on all contracts, was approved by SSD and AFPRO, LMSC. A sincere effort is being made in improvement of configuration control procedures also, and although progress has been somewhat slower, it has been encouraging. Both programs should provide benefits to all LMSC contract efforts.

7. (U) During this period a NASA-USAF agreement entitled "Gemini Atlas Agena Target Vehicle System Management and Responsibilities Agreement" was negotiated and signed by Gen Funk for SSD and Dr. Gilruth for NASA, MSC. This document serves as the basic delineation of management responsibilities for the Gemini Agena Program. In May 1965, the first Gemini Agena Target Vehicle received First Article Configuration Inspection (FACI) and was shipped to the Eastern Test Range. The second and third vehicles were well along in assembly and test. The total program has been reduced from seven to six vehicles when procurement of one vehicle was terminated in April. A major technical problem was resolved by implementation of a special 10 point program to reduce manufacturing and quality assurance difficulties in the Command Programmer and the Command Controller.

8. (U) The Burner II vehicle entered the acquisition phase (Phase II) with award of contract to the Boeing Company as a result of Source Selection Board action. The Phase II effort includes development of AVE, AGE, personnel subsystem, support subsystem and logistics to define the Burner II system. Contract AF 04(695)-754 was negotiated in the first quarter of CY-65 with go-ahead provided to the Boeing Company on 1 April 1965. Design effort was the primary activity during the second quarter of CY-65 in preparation for Critical Design Reviews scheduled for the third quarter of CY-65.

9. (U) Engineering activity continued at a high level during the reporting period. Many component improvement and test programs were initiated or continued. Activity continued on the Titan III/X/Agena development and contractor proposals for major improvements to the Agena vehicle were evaluated.

a. A using program has been selected for the Titan IIIX/Agena combination. Development of the Agena booster adapter is continuing with static structural testing scheduled for September. Consideration of Titan IIIX/Agena interface requirements revealed a problem in command destruct circuitry. This problem is now under study.

b. The Production Reliability Evaluation Program (PREP) entered the fifth round of testing. Each round tests approximately 35 Agena components which are selected at random from the production hardware associated with a lot of 20 vehicles. Round V covers vehicles AD-121 through AD-145. Planning for Round VI has been initiated.

c. An extensive Agena spares screening program was initiated during this period. All Standard Agena spares were reviewed and evaluated against established criteria in order to eliminate components which were not considered flightworthy. The basic purpose of the program is to increase reliability of the Agena vehicle and the spares provided through logistic support. Procedures were established for initiation of a continuous spares screening program.

d. In the Structures Subsystem, a program was initiated for development of an improved separation joint. Several improvements aimed at reducing leakage were incorporated in the vehicle plumbing system, and evaluation of a Lockheed developed alloy of beryllium and aluminum called Lockalloy was initiated.

e. Propulsion Subsystem personnel were involved in the indoctrination of Bell Aerosystems Company as an associate contractor for the Agena rocket engines. Propulsion Improvement programs included development of a propellant fill coupling with a 15-day hold capability, redesign of the sensor bar pinpuller and initiation of a test program on the secondary propulsion system.

f. Electrical Power Subsystem personnel were concerned with a wide variety of improvement programs. An on-orbit partial failure of the Type IX DC/DC Converter generated an intensive investigation of problems in this component. Satisfactory corrective action has been accomplished and the program to develop an improved converter, the Type XVII, has been accelerated. Performance of primary power sources was satisfactory during this period; however, there was an increase in ground failures for the Type V and Type VIA secondary batteries. Vendor quality control and battery charging procedures are being investigated as possible causes. In addition to the Type XVII Converter, development programs have been initiated for the Type XA Converter, the Type XIV Battery, the Ampere-hour Meter and for wire harnesses and electrical connectors.

g. Modifications or improvements were initiated or considered for most Guidance and Control Subsystem components. Some of the changes involved incorporation of new piece parts such as the transformers in the Flight Control Electronics assembly and relays in the Guidance J-Box. The first flights of the Mod IIC Horizon Sensor as an integral part of the vehicle guidance system occurred during this period with successful performance. An extensive proposal for redesign of the Velocity Meter was received and is being evaluated.

h. Activity in the Communications and Command subsystem was primarily centered on problems encountered in the design and production of the Gemini Agena Target Vehicle C&C equipment. An intensive effort, including investigation and discussion with Gen Funk and Mr. L. E. Root of LMSC, was required to convince the contractor that a problem existed. By the end of this period, extensive redesign, additional testing and improved manufacturing and failure analysis procedures have resulted in a C&C system of greatly improved quality and reliability.

10. (U) A study of Aerospace Ground Equipment (AGE) problem areas and recommended solutions was initiated during the reporting period and a contract for improvement of the AGE Power Supply System was negotiated. Activity on the conversion of Launch Complex 14, Eastern Test Range, to accommodate the Gemini Agena Target Vehicle configuration continued with a vehicle on stand capability scheduled for July 1965. The proposed Titan III ILC/ITL facility at WTR was reviewed to insure that the Agena vehicle could be accommodated in the event a requirement develops.

11. (U) Progress in configuration control activities was notable during this period. A configuration control program was established for the Gemini Agena Target Vehicle and the First Article Configuration Inspection (FACI) for this vehicle was planned and conducted. Configuration control was instrumental in the evaluation of the Agena engine contract with Bell Aerosystems Company. Implementing instructions were prepared for configuration control on the Standard Agena production contract (Letter Contract AF 04(695)-722) and the Burner II contract.

12. (U) The attached reports contain detailed information on the activities of each Division within the Agena Directorate.

~~William C. Nielsen~~

WILLIAM C. NIELSEN
Colonel, USAF
Director, Agena
Deputy for Launch Vehicles

6 Atch
Historical Data
1. Rqmts & Prog Div (C).
2. Procurement Div (U).
3. Gemini Agena Target Veh Div (C).
4. Vehicle Engineering Div (U).
5. Aerospace Ground Equip Div (U).
6. Configuration Management Div (U).
7. Burner II Div (C).

~~CONFIDENTIAL~~

Requirements and Programming Division
Historical Data
1 January 1965 - 30 June 1965

1. ~~(C)~~ Agena Flight Summary

On 31 March 1965, SSVA distributed the Agena Flight Summary Report to program and staff offices within SSD, Hq AFSC and Hq USAF. This report described and assessed all Agena flights through 31 Dec 64. During the period 1 January 1965 to 30 June 1965, 15 Agena vehicles were flown making a total of 169 flights. Of these 15 flights, 13 were of the current Agena D configuration. The remaining 2 vehicles were Ranger flights by NASA using Agena B's. The last 25 Agena flights have been successful and the overall success ratio of the Agena D now stands at over 92%.

2. (U) Production Reliability Evaluation Program

During this period the Production Reliability Evaluation Program (PREP) testing continued. The third series of tests (Round III) was completed in June 1965. With the exception of one Reliability Analysis Report and a Diode Special Study, Round IV was also completed in June. Round V was started in April 1965 and was approximately 20% completed by 30 June. Preliminary planning for PREP Round VI was essentially completed on 30 June 1965.

3. (U) Quality Assurance Program

On 22 May, the AFPRO at LMSC approved a new LMSC Quality Assurance Program Plan which is in full compliance with MIL-Q-9858A. This plan culminates a year of effort during which LMSC prepared and submitted several unacceptable plans. The effort was accelerated and given top management support as a direct result of the meetings between Gen Funk and Mr. L. E. Root of LMSC which were required to resolve quality problems on the Gemini Agena Target Vehicle. The plan is now in effect and is being implemented through written Operating Procedures.

4. (U) Agena Production Authority

On 16 February 1965 concurrence was received from AFSC to reduce the -722 production contract from a total of 57 to 43 vehicles, pending a decision on the SLV-3M.

On 17 February 1965, a Letter Contract was sent to LMSC to procure 43 vehicles.

On 30 April 1965, direction was received from AFSC to return to the original buy of 57 vehicles (4 veh/month delivery rate) at the earliest effective date consistent with cost.

DOWNGRADED AT 3 YEAR INTERVALS
DECLASSIFIED AFTER 12 YEARS

Final -722 delivery schedule is as follows:

O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J
1	3	3	4	4	4	4	4	4	4	4	4	4	4	4	2

5. (U) LMSC Operating Schedule

LMSC Official Operating Schedule, Issue #27, was distributed to the Program Offices on 18 June 1965. The Lockheed Schedule depicts the milestones, systems test and launch stand loading for all programs using the Agena vehicle. SSVAR acts as the SSD central point of contact for LMSC in coordinating and obtaining approval for the information presented in this document.

6. (U) Work Statements

During this time period the following work statements were prepared and/or submitted to SSVAK for contractual action:

a. Agena Vehicle Storage from June 1965 through July 1966. Work Statement issued 19 April 1965.

b. PREP Round V covering vehicles 103 through 120. Work Statement submitted on 19 April 1965.

c. Standardized Work Statement Package to be used in connection with the BOA, Contract AF 04(695)-589. This package consists of separate formats for each of three categories which generally apply for this contract; PREP testing, Hardware Improvement, and Studies. The system is designed to allow rapid administrative handling and enable work to begin on a particular effort (including contract negotiation and signature) within two weeks after Program Plan approval.

6. (U) Agena Improvement Drive

In February 1965, SSVA received the LMSC Agena Improvement Drive (AID) proposal. AID was a three point program aimed at improving the probability of mission success of the Agena. The three areas of effort under AID included:

a. An expanded Production Reliability Evaluation Program (PREP),

b. A thorough review of current acceptance test procedures and specifications, and

c. A Component Screening Program.

After receiving inputs from the LMSC AFPP and the Agena using programs (AF and NASA) SSVA replied to LMSC on 7 April 1965 with the following direction regarding the AID proposal:

a. Standard Agena plans to include [illegible] levels of environmental testing in future PREP rounds.

b. PREP testing of programs peculiars should be handled on an individual program basis.

c. SSVA recommended that LMSC pursue the Acceptance Test Review on an individual program basis and establish procedures to assure consistent and continuous review.

d. SSVA endorsed the following aspects of the Component Screening Program: Spares Screening, Component Pedigree, and Continuous Component Screening. Joint LMSC/Air Force efforts in Spares Screening are covered in paragraph 2.

7. (U) Agena Spares Screening

To carry out the spares screening functions recommended in the LMSC AID Proposal, a joint AF/LMSC Spares Screening Committee was established by SSVA. Chaired by Lt Col E. A. Lembeck, II of the AFPRO at LMSC, the committee held its first meeting 12 April 1965. The purpose of the spares screening was to increase the confidence level and reliability of the spares used on Agena missions. By the end of May 1965, the screening committee completed screening of the Standard Agena Spares. The Screening Committee also made recommendations for a continuous screening effort. These recommendations were forwarded to SSVA for consideration.

8. (U) Agena Long-Range Improvement Program (Phase II)

The LMSC Agena Long-Range Improvement Program (Phase II) Proposal was received by SSVA in February 1965. The objective of the proposal was to increase the orbital reliability of the Agena vehicle through hardware changes. Some of the major hardware changes proposed included: simplified engine control circuitry, integrated guidance module system, decentralized power conversion, UDMH actuators, improved wiring, and improved connectors. SSVA approved the following changes in a letter to LMSC in May 1965: improved wiring, improved connectors, P-700 and P-701 changes, pressure transducer improvement, and new J-100 umbilical. LMSC was requested to provide additional information on the following proposed changes: simplified engine control circuitry, new three axis accelerometer, and propellant vent coupling redesign. LMSC was scheduled to present this information 9 Jul 65.

9. (U) This report is classified CONFIDENTIAL because of Paragraph 1, which reveals Agena flight success ratio.

Procurement & Production Division
Historical Data
1 Jan 1965 to 30 June 1965

1. During the period the Procurement and Production Division (SSYAK) supported the Agena Directorate by issuance of 7 new contracts, definitization of 2 letter contracts and administration of 43 active contracts. Total estimated value of these contracts is approximately $450,000,000.

2. During the period decision was made to directly procure from Bell Aerosystems Company the Agena engines and furnish engines to Lockheed Missiles and Space Co. as Government-furnished equipment. The first buy was for fifty-five, 8096 engines and two 8247 engines for the Gemini Program. In order to meet the requirements letter contract AF04(695)-766 was issued. Negotiations for the definitization of this letter contract were scheduled for July of 1965. Contract is to be definitized on a Firm Fixed Price basis.

3. During the period Letter Contract AF 04(695)-722 was issued with LMSC for the follow-on buy to the AF-451 contract. This letter contract is for the delivery of 57 Agena vehicles with engines furnished as GFE. Negotiations started during the period for definitization but were not completed prior to 30 June.

4. During the period Letter Contract AF 04(695)-737 was definitized into two individual contracts, AF 04(695)-688 and AF 04(695)-689, for launch services at ETR and WTR. For WTR the period of performance was for 15 months.

5. During the period the first Basic Ordering Agreement, AF 04(695)-589 was issued with LMSC. This contract provides for individual cost reimbursement calls on an incentive basis for Agena engineering efforts. Also, a fixed price BOA was forwarded to LMSC, but has as yet not been signed.

6. During the period Letter Contract Amendment No. 27 to Contract AF 04 (695)-129 was negotiated with all the overage CCNS to Contract AF 04(695)-545. The amendment will be incorporated into the AF-545 contract during July.

7. During the period a complete screening of all spares to support the Agena Vehicles was started. Upon completion of this screening a system of spares rotation will be instituted to preclude the obsolescence of spares inventory.

8. During this period the General Accounting Office has undertaken the investigation of the Minneapolis-Honeywell Co. subcontracts under the LMSC production contract for purposes of determining if excess profits have been generated. Final decision had not been reached as of the end of June.

9. Fact-finding at Bell on 3-5 May 1965, established the fact that replacement of certain test facilities were urgently required. The Agena Directorate made the necessary money ($260,000) available for the required replacement. Also, a complete review of all facility items was undertaken to ascertain its condition and possible need for updating.

10. Contract AF 04(695)-761 for sustaining services at Santa Cruz Test Base, California, during the period 1 July 1965 through 30 June 1967, was negotiated with LMSC and distributed. The contractor is required to maintain test stands 1 and 2 and associated block house in a condition to receive systems and hot fire tests.

11. Burner II Program with The Boeing Company, Seattle, Washington, was finalized 30 March 1965 to be effective, April 1965. Contract AF04(695)-754 covers fabrication, testing and delivery of three vehicles to WTR to be test flown by a Blue Suit AF Team.

12. During the period Contract AF 04(695)-715 was negotiated and definitized. This contract covers the requirement for improvement of the Environmental conditions for the Agena Vehicle. This required study, engineering and modification of AGE equipment.

13. During the period effort was started and negotiations completed on L/C AF 04(695)-821. This contract covers the updating and modifications for the AGE Power Supply. The L/C was not issued nor definitized prior to 30 June.

[illegible] REPORT
January [illegible] - 30 June [illegible]
Agena Vehicle Branch
([illegible])

A. Spaceframe Subsystem (SS/A)

The following items summarize major activities of the Spaceframe Section during the subject time period. Principal section effort was provided for the Titan IIIX/Agena, Gemini Agena Target Vehicle, Zipcord Separation Joint evaluations, review of program plans and SS-01B configuration control with review and action on design changes. In addition, continued support has been given to programs using Agena.

1. Titan IIIX/Agena

A program has been selected to use the Titan IIIX/Agena combination. The Agena/Booster adapter design is essentially the same as proposed previously except for more access. Design of the booster adapter is virtually complete with nearly all engineering released. The one major unresolved design area is the primacord separation joint. Greater vehicle loads dictated an increased skin thickness in the separation area. The skin is up from 0.143 inch to 0.160 inch and is changed from HM21A-T8 to HK31A-T24 magnesium alloy. The skin thickness to be cut with the primacord remains the same. To validate the new joint, twenty panel tests were conducted. The cutting action was satisfactory, however, the primacord charge back-up ring cracked on nineteen of the twenty tests. The back-up ring is the ring presently used.

Static structural testing of the booster adapter is scheduled to begin in September 1965. Testing of the adapter will be combined with testing of the Titan IIIX forward section and will be performed by the Martin Company at Denver, Colorado.

During the last four months of the report period, a substantial effort has been expended on the total interface between the Titan IIIX and Agena. The preponderance of discussions on the interface concerned system compatibility. One major problem remaining is time phasing in the command destruct circuitry. It appears the Agena may destruct and thereby damage the destruct circuitry before the Titan attains irrevocable destruct. Another problem of redundant discrete circuitry for reliability purposes will be achieved by design changes by both LMSC and the Martin Company. Other circuitry improvements will be made at the same time for improved reliability. The Standard Agena pin assignments will remain the same as presently used.

The Agena aft section roller assemblies and supporting structure will be strengthened to meet the requirement of one Titan IIIX retrorocket out condition. The retros are located at the aft end of Titan Stage II. The long moment arm between the retros and the vehicle center line results in a bending moment increase of 400% at vehicle separation for the one retro out condition. The strength increase will result in two pounds additional aft section weight.

2. Gemini-Agena Target Vehicle

GATV Shroud Evaluation. Based on a flight failure history and insufficient engineering confidence, the modified A-12 shroud has not been considered by the contractor to be flight worthy. Certification has, therefore, not been issued. After conducting a detailed design review, both Aerospace and AFSSD personnel have agreed with Lockheed's conclusions. Recommendations have, therefore, been forwarded to NASA regarding the necessity of certain structural modifications and subsequent qualification tests. This effort has been authorized and procedures are being implemented to carry out this work. A detailed review of the test plan will be made prior to any testing and a data analysis will be executed upon completion of all tests.

GATV Control System Analysis. It has been the aim of an Industry-Government Team to evaluate the capability of the Standard Agena Control System for the docked configuration. To this end, this office has participated in numerous test discussions and related technical reviews. To date the McDonnell Corporation has performed a series of full scale dynamic response tests using a Gemini spacecraft and the forward structural sections of the GATV. The data gathered, relating to damping, cross-coupling, and modal frequencies has been made available to Massachusetts Institute of Technology and used in an analog computer program. The latter has been completed and the results reviewed by all parties concerned. At this time MIT is awaiting additional information from McDonnell as to damping characteristics before executing their final program. Existing results indicate that the stable gain region for the Standard Agena Control System does not provide an adequate safety margin and that a modification would have to be incorporated. Such a change is under consideration.

Structural and Thermal Acceptance. To insure that all structural and thermal requirements are met for the Agena Target Vehicle, this office has undertaken a continuing review of these technical areas. Specific problems have been attributed to galvanic corrosion consideration, clearance provisions, secondary propulsion system alignment verification, mating surface tolerances, and plumbing integrity. At present, a final study of primary battery characteristics is being performed, the results of which will be used in a thermal analysis of the type 1C batteries. Their operating temperature is critical and every effort will be made to maintain them in the proper environment.

[redacted]

3. Zipcord Program

In an attempt to eliminate particle contamination during booster adapter separation and appreciably reduce the longitudinal shock induced into the structure, the Air Force has funded Lockheed to investigate the zipcord joint for possible application. A Phase I development effort was completed which established a thermal environment of from 70° - 350°F for the joint. To find a compatible jacket material to contain the primacord, an interim test effort was carried out at the Lockheed Santa Cruz Test Base. Both a single material (silica filled neoprene) and a composite (Viton A with silicone rubber) have proved adequate. At present this office is evaluating a cost proposal for the Phase II development effort. This eight month program will hopefully result in a well integrated system with optimum functional characteristics. Under a new contract agreement, an AFSSD work statement is being written for this Phase II effort.

4. Plumbing Improvement Program

Since January of this year a great deal of progress has been made in upgrading the quality and thereby improving the performance of the Agena plumbing system. As the result of a joint AFSSD-Lockheed Industry Survey lasting two weeks, many recommendations were presented which have been reviewed and to a varying degree acted upon. The following items are some of the changes which are to be incorporated:

An orbital flaring adapter has been put into use at Lockheed which produces very high quality tube flares in accordance with a NASA MC-144 specification. Within the near future all vehicle flares will be of this type.

To minimize joint leakage and certainly reduce unnecessary repair action at the launch base, procedures have been initiated to qualify a new Wiggin's "DL" nut and sleeve. This separable connector has been subjected to a preliminary design review and all conclusions indicate it will be an order of magnitude improvement over the existing "AN" design. The latter was developed for use in hydraulic systems of propeller driven aircraft and not for high pressure pneumatic lines of space vehicles.

With the development of such systems as the B-70 and the Gemini spacecraft, the technology of permanent joints has improved significantly. An induction brazing technique has indications of great application to both vehicle and AGE equipment. This process will very shortly be subjected to review along with other possible approaches to permanent joint design.

The quality of the Agena tubing, particularly aluminum, has been considered unacceptable at times. To insure quality, tubing will be procured on a regular basis. A vendor has been contacted that will be able to meet the rigid LMSC specification.

Numerous other innovations have been or will be considered which will collectively reduce plumbing problems to a very low rate of occurrence.

5. Lockalloy Evaluation

In order to effectively reduce vehicle inert weight through use of an efficient structural material, Lockheed has expended in-house resources and effort in the development of a Be - 38% Al alloy, herein referred to as lockalloy. The latter closely approaches the strength characteristics of pure beryllium as is used for the Agena's forward section skins, but unlike beryllium, it possesses fine ductility, formability, weldability, and machinability characteristics. Lockalloy is considered, from all indications, to be a most efficient material. It can be subjected to complex stresses and high loading conditions which other materials cannot tolerate due to weight or loading limitations. This office is presently supporting Lockheed in their attempt to "sell" lockalloy to the Materials Laboratory at Wright Patterson AFB. If the necessary evaluations are performed so that a design data handbook can be compiled, both the Air Force and industry will undoubtedly find numerous applications for lockalloy.

Extracted from
Historical Report
[illegible] 1 Jan - 30 June 65

1. Propulsion Subsystem [illegible]

1. XLR81-BA-11

In January 1965 the decision was made to procure this engine direct from Bell Aerosystems Company as an associate contractor. The first engine under this contract arrangement will be S/N 679 and is scheduled for delivery in July 1965. These engines will be furnished GFE to the Lockheed Missile and Space Company for use in the Agena space vehicle. Fifteen engines have been flown during this reporting period with successful engine operation on all flights.

2. XLR81-BA-13

This engine will also be procured direct from Bell Aerosystems Company as an associate contractor and furnished GFE for use in the Gemini Agena Target Vehicle.

The oxidizer gas generator valve has continued to be plagued with problems and is undergoing quite extensive manufacturing technique changes. Completion of the flight verification program is now scheduled for September 1965.

3. Secondary Propulsion System

Regulator Redesign. The test program indicated the creep problem to be eliminated. However, the regulator demonstrated a rapid shift due to cold soaking. A test program is presently underway to demonstrate that this shift can be pre-set into the regulator by cold soaking during the acceptance of each regulator.

Trim Orifice. Difficulties encountered during acceptance test of the SPS thrust chambers revealed a tendency of the propellant trim orifices to cavitate a flip or change performance. A test program determined the proper relationship between the trim and metering orifices and the flipping has been eliminated.

4. Vehicle 5001

This vehicle, with two SPS modules and the first production XLR81-BA-13 engine, was successfully hot fired at Santa Cruz Test Base. Following the hot firing the First Article Configuration Inspection (FACI) was conducted on this vehicle.

5. Propellant Feed, Load, and Pressurization System

A program to develop a 15 day on-pad-wet capability for the propellant fill coupling was initiated. The coupling will also be made non-interchangeable between the fuel and oxidizer sides. Incorporation of LMSC-Vandenberg design changes into the ground-half, on the vendor's drawings, will enable follow-on procurement of the ground-halfs. None of the ground-halfs have been procured for several years.

During this report period one S-01B restart mission was flown with successful restart achieved (Snapshot). This was the first S-01B restart vehicle without a cold gas system to maintain propellants over the sumps during coast. Passive ullage control was not fully demonstrated, however, because pre-flight analysis indicated that the propellants remaining would be stabilized over the sumps during coast.

6. Sensor Bar Pinpuller

A redesign of this pinpuller was initiated to eliminate the corrosion problem and the retaining spring manufacturing problem. Development testing has been completed and manufacturing of qualification units initiated.

HISTORICAL REPORT

C. ELECTRICAL POWER SUBSYSTEM ([illegible])

1. Personnel History:

a. Subsystem manning did not change during 2nd half of FY 65. Current utilization is as follows:

Name	Function	Auth Grade/Grade	Duty/Req AFSC/AFSC
* T. D. Tedrick	Sr Project Officer	Capt/Maj	2821/2825
G. R. Pisarczyk	Project Officer/Pwr Dist	1st Lt/Capt	2821/2825
**R. L. Bush	Project Officer/Pwr Source	1/lt/Capt	2895/2825
L. M. Kikuta	Project Officer/Pwr Conv	2/Lt/Capt	2821/2825

* Notified of impending "Return to Cockpit" Assignment
** PCS NLT August 1965

b. Participation in Using Program activity significantly increased with added support for Burner II and Titan IIIX, additional Using Program Flight Failure investigations, and the new component study, development, and modification efforts.

2. Component History:

a. Power Conversion Equipment:

(1) Type IX DC/DC Converter - A third flight malfunction of this component occurred which resulted in a 50% loss of the Using Program's mission. The failure is believed to have been caused by loss of the negative output series regulator. Corrective action was to initiate individual unit evaluation and selection for flight; to require temperature cycling during acceptance to detect poor workmanship and marginal piece-parts, to accelerate the modification program (Type IXA), and to utilize a redundant (2 converter) system for one using program. Performance for all other flight vehicles and in all special ground tests (PREP, etc) has been satisfactory.

(2) Ampere-Hour Meter - One flight malfunction occurred, however, its extent was minor and no loss of mission was experienced. The malfunction is believed to have been caused by a "flip-flop" failure in the digital readout section. Temperature cycling during acceptance to detect poor workmanship and marginal piece-parts has been initiated. Performance in all other flight vehicles and ground tests have been satisfactory with the exception of PREP Round IV in which continued out of specification conditions were experienced with the variable frequency oscillator, (VFO).

(3) Type X DC/DC Converter - No significant ground or flight problems were experienced with this component. Use of this converter as the BTL guidance system power supply is expected to stop if satisfactory results are obtained from a feasibility study on operating the BTL system on unregulated DC power.

(4) Type XIIA, DC/AC Inverter - Flight performance of this component has been satisfactory however, two ground test problems were experienced. The varying load conditions of a payload tape recorder and the sequence timer motors caused reflection of a back voltage into the output of the inverter producing excessive voltage modulation. Corrective action was to replace a series resistor in the output filter of the inverter with a one microfarad capacitor which blocks the back voltage. A minor problem of continued "out of specification" condition was experienced with the crystal frequency control in development life tests and in PREP Round IV Tests during temperature extremes.

b. Power Distribution

(1) Six basic Agena electrical junction boxes have completed PREP Round V Test with no indication of anomalies.

(2) The main power distribution box was modified to provide for linear measurement of pyro bus current (signal conditioning) and by increasing access to pyrotechnic power functions for using programs.

c. Power Sources

(1) Primary Batteries - Internal encapsulation of all conductive surfaces and increased thermal control begun in Dec 1964 has provided for problem-free performance of Primary Batteries on all flights during the past six months. Increased attention is now being placed on activation and handling of batteries during the prelaunch activities. Preparation of a new detailed activation procedure was completed in May 1965.

(2) Type I F Battery - Qualification of this battery was completed in May 1965. The Type I F has increased wet stand capability by 30% and power density and capacity by 10% over those batteries previously used. Modification of the vehicle to permit installation in the Standard Agena forward rack and the UPA Kit is now underway.

(3) Secondary Batteries - Ground failures and rejection during prelaunch charging of the destruct system batteries (Type V and Type VIA) sharply increased during June 1965. Inadequate vendor quality control and improper charging practices are suspected.

c. Piece-Parts

(1) The [illegible] relay was found to be sensitive in the lateral axis to sinusoidal vibration in the region from [illegible] to [illegible] cps. To eliminate this problem, modifications were made by the vendor which consisted of adding a stiffener spring to the stationary contacts and to the coil support structure to provide stiffening to the relay can. Since the above change did not affect form, fit or function a part number change was not made and traceability was provided through lot numbers only.

(2) Certain types of glass diodes similar to the LS8481-001 have exhibited a failure mode which consists of cracked or broken glass outer cases. The cause appears to be primarily due to stresses which are exerted by the conformal coating material primarily when exposed to environmental stress test conditions. The impairment of the electrical characteristics vary from slight degradation of the forward current/voltage characteristics to an open diode.

(3) Connectors - Rejection of Deutch DTK and Hi-Rel equivalent connectors due to split and torn grommet has become increasingly serious. Although early evaluation indicated deficient design was responsible, the actual cause was determined to be due to the use of improper or inadequate tools during the assembly operation and lack of quality control. The contractor was requested to eliminate all improper shop aids and tooling; to provide adequate standard tooling; to use a harder grommet material (50 shore hardness silicon rubber); and to initiate operator certification, work traceability and retraining classes.

3. Special Projects

a. Type IXA Converter - This 11 month $300,000 effort to modify the Type IX DC/DC converter to withstand certain overload conditions and externally applied voltages has progressed past the 1st scheduled design review. The first flight unit is tentatively scheduled to be delivered in February 1966.

b. Type XA Converter - This $175,000 eleven month effort to modify the Type X DC/DC converter to withstand certain overload conditions and externally applied voltages and to improve reliability may be cancelled and the BTL guidance system run on unregulated DC voltage as a means to simplify the vehicle. Feasibility of this change is being determined.

c. Type XIV Battery - A six month $225,000 effort to continue development of this zinc-oxygen battery system was initiated in June 1965. The objective of this project definition program is to provide an optimum electrical power source with a minimum energy density of 150 watt-hours per pound, a 50% increase over silver-zinc batteries. The prime contractor (LMSC) is to conduct vehicle integration and accomodation studies and the subcontractor (Eagle-Picher Co.) is to conduct parametric studies and a functional cell testing program.

d. Ampere Hour Meter - A [illegible] month 3/4 manyear effort was initiated to establish the design requirement for an improved solid state integrated ampere hour meter and to select a vendor for development.

e. Wire Harness and Connector - An evaluation of improved "Space-weight" wiring and improved connectors (NAS 1599) is expected to be initiated.

f. Fuel Cells - Cooperation with the R&TD Aero-Propulsion Laboratory in Fuel Cell development and testing was begun in March 1965. Prototypes of the Allis-Chalmers "capillary" fuel cell were tested to 6117D environmental levels and discharged to an Agena Using Program Power Profile. Future action will be to assess expected follow on program requirements and to assist with the FY 66 R&TD Fuel Cell Program by providing funding and technical input (if the Using Programs establish a firm requirement).

4. Gemini Agena Target Vehicle Program Support

a. The LMSC Gemini Program Office was directed in February to replace all of the Struthers-Dunn 10 amp relays identified by LMSC part number 1614945 that were used on the Gemini Agena Target Vehicle. The 1614945 relay was affected by rust deposits in the vicinity of the pivot pin on the relay armature. The affected relays were replaced by the 10 amp Babcock relay identified by LMSC Part Number LS40533.

b. Review of the Detail Specification for the Gemini/Agena Target Vehicle (LMSC 1417169) was accomplished with final SS/C approval based on rewriting separate specifications for the program peculiar junction boxes and having these added as an integral part of the detail specification.

c. Installation of the LS40533 relay in the Forward Power Distribution junction box required that the relay mounting bracketry be modified and a subsequent need to requalify the box. The box failed the requalification test due to relay transfer caused by excessive cross coupling of g loads during sinusoidal vibration. Extensive testing was then run on the junction box to determine an optimum mounting configuration for the relays and the box has resumed qualification testing.

d. FACI for Vehicle 5001 was conducted in May. Drawings, manufacturing data, qualification reports and FEDR's were reviewed for all junction boxes and conversion equipment. Harness drawings, harness installation drawings and manufacturing, test and acceptance data for the harnesses were also reviewed. Subsystem C FACI activity (documentation review) was completed 20 May.

e. Similar support was provided for a review of Vehicle 5002 systems test data and for FACI of Vehicle 5002.

HISTORICAL REPORT

D. Guidance and Control Subsystem (G&CS)

1. Flight Control Electronics Assembly

A redesign proposal program plan was received from LMSC. A Work Statement was prepared under BOA L-6. It is, however, being held pending a study of a new FCE concept.

Twenty-five transformers used in the FCE will be replaced effective with AD-132. Earlier incorporation (AD-121) was not possible as LMSC required additional testing at the system level. These transformers will correct the failure modes found during temperature testing.

Two additional tests are being incorporated on the FCE ATP to ensure detection of transformer induced anomalies which were noted on six Agena flight histories.

2. Flight Control J-Box

The Flight Control J-Box test procedures incorporated temperature testing for all units effective with AD-114.

3. Guidance J-Box

The G. E. Hi-Rel relay (LS 8453) was replaced because of teflon contamination. There are twenty-three relays of this type used per box. A Potter-Brumfield relay (with a glass actuating bead) was used as a replacement. It was previously qualified. The change was effective, in line, from AD-100 and up. For AD-83 thru AD-99 a rework program was necessary. The box from AD-99 was used as a sample for rework and confidence testing. The testing included temperature cycling and a qualification level shake. The sample unit passed successfully. All using programs accepted the reworked box except SP-7.

Temperature testing was incorporated into the ATP with AD-112 and up.

4. Sequence Timer

The LMSC proposal for a development timer concept to be used to correct switch and counter anomalies was accepted. A Work Statement was written and submitted for SSVA approval.

5. Yaw Sensor

A vehicle carrying the yaw sensor is scheduled to fly in September 1965. Progress of flight test plans was reviewed 5 May. Installation drawings are complete and a satisfactory TM schedule has been prepared. The yaw sensor was checked out at MIT and then shipped to LMSC.

6. Inertial Reference Package

VRIC's 48062 (null change), 48066 (TCA transformer change), 65814 (closed loop stiction test) and 65817 (transistor power amplifier change) were incorporated into the IRP on one ECP. The Design Control Specification was revised to reflect these changes and assigned a new number, DCS 1461836.

7. Mod II Control Moment Gyro

Two qualification gyros failed to complete the qualification testing without significant problems. A lack of quality control during CMG fabrication was determined to be the major cause of the problems. The CMG basic design was determined to be satisfactory so LMSC issued a statement of qualification. However, this qualification statement was not issued until Nortronics completely revised their quality assurance program and vendor acceptance testing. The most stringent acceptance test change was the increase in random vibration to the qualification spectral density for 90 seconds in each gyro axis. The delivery of flight gyros is expected to begin in August 1965.

8. Velocity Meter

The LMSC proposal for an improved Velocity Meter, DVM IIA, was accepted by SSVAE. A Work Statement was written and submitted for approval by SSVA. The proposed DVM IIA will have better performance and should eliminate most of the out of tolerance FEDR's associated with the DVM II.

9. Mod IIC Horizon Sensor System

The qualification tests on the improved UTC transformer and the Sauereisen #31 encapsulated magnetic pickups were completed. The UTC transformer and the new magnetic pickup were incorporated at S/N 850 and the Horizon Sensor System was reidentified as a -19 system.

The first flights of the Mod IIC Horizon Sensor as an integral part of the vehicle guidance system occurred during this period. Flight data indicated very good performance.

The failure of the pressure transducers to meet specifications created problems in production of horizon sensors. Corrective action in the form of improved process controls and procedures was implemented by the vendor; however, the effectiveness of this corrective action is unknown at this time. This problem is not critical because flight performance is not dependent on the pressure transducer.

10. Component Screening of Spares

A committee was organized at the request of LMSC AFPRO to purge the Standard Agena spares. The purpose was to eliminate components that were not considered flightworthy. Four subcommittees were established to screen spares for Subsystems A, B, C, D, and H, using criteria established by the committee. Upon completion of screening the committee reconvened to establish procedures for implementing a continuous spares screening program. The continuous screening program is awaiting approval by SSVA.

E. Communications & Command Subsystem ([illegible])

1. Command Destruct Receiver Design Improvements: Advanced Communications, Inc., proposed several design changes to their Command Destruct Receiver Model R422. These changes involved parts substitutions and mechanical changes which reduced cost by reducing manufacturing time, and increased reliability by reducing piece part count and improving electromagnetic interference characteristics. These changes were approved, and a program plan was funded for ACI to build and qualify an improved receiver. The qualification unit was completed in May and the qualification tests were performed during the period 2-17 June. Only minor problems were encountered, and the unit is now considered qualified. It is scheduled for incorporation on Vehicle AD 132.

2. Agena Type V Telemeter:

a. Time delay and Modulation Amplifier: The Engineering Change Proposal required to incorporate these two modules has been completed, and incorporation is scheduled for Agena D #132.

b. Commutator: The Fifth Dimension commutators have now been qualified. The main problem encountered in the qualification was in the design of the input filter and the application of the transistor in that filter. This problem was corrected by use of a transistor of higher rating. The new commutator design is scheduled for incorporation in Vehicle AD 132. Lind Instruments, Inc., commutators were qualified during the previous reporting period.

3. PAM Type III Telemeter: The Pulse Ampitude Modulation (PAM) Type VIII Telemeter that was installed on Vehicle 7001 failed at Vandenberg AFB shortly before scheduled launch time. The failure was caused by workmanship error in that a wire had been broken near a contact and only a partial solder connection existed. It is interesting to note that this error apparently was not caught by a visual inspection and it remained undetected during initial acceptance testing, engineering evaluation testing, vehicle systems test and initial vehicle testing at Vandenberg. The unit that was installed on the vehicle following this failure operated satisfactorily in flight.

4. Three Way Coaxial Switch: The qualification of the Transco Products, Inc., switch was completed in mid-February, and the final design review was performed on the 5th of March. The switch is scheduled for incorporation on Vehicle AD 132.

5. Improvements to the Gemini Agena Target Vehicle (GATV) Communications and Controls Equipment: In the Winter of 1964-1965 the efforts of the Air Force's Agena electronics engineers to investigate hardware failures, failure analyses, and corrective actions on Gemini-Agena Target Vehicle C&C equipment were met with inertia and passive resistance at some levels of the contractor's management. Air Force persistence finally led to a complaint by the contractor's

program office, lodging over a dozen separate charges such as interference with management, obstructing manufacturing, etc., against the engineers of Agena Subsystem E, then managed by Lt. Colonel William D. Greenfield, M.S.E.E. The result was a presentation on 23 February 1965 by company representatives and by Agena Subsystem E to Major General Ben I. Funk, Commander, AFSSD, and Mr. L. Eugene Root, President of Lockheed Missiles & Space Co.

At this conference the company presented generally-worded assurances that all was well with the hardware. The Air Force presentation countered with specific information by the Configuration Control Office (SSVAC) concerning LMSC's malpractices, and was capped by an analysis written and presented by Lieutenant Colonel Greenfield on "Critical Problems Associated with the GATV C&C Subsystem." The presentation contained only documented facts and established that upon an electronics failure, one or more of the following actions frequently were lacking:

a. Verification,

b. Determination of failure mode,

c. Determination of failure cause,

d. Determination of degradation in associated circuitry,

e. Decision as to appropriate corrective action, and

f. Follow-up or implementation of corrective action.

With the existence and nature of the problem established, Colonel Greenfield next presented a ten-point improvement program for the GATV C&C gear. Among the ten points were producibility improvements, furnishing a programmer memory assemble to Stanford Research Institute so that actual hardware tests might be performed on subcontract 28-7041, adequate failure analysis and corrective action, and continued involvement of design engineers with their hardware. A copy of the presentation is attached.

The response to the facts was predictable and immediate. The Company's managing officers promised General Funk rapid embarkation on such an improvement program and in fact later adopted the entire ten-point program as presented in this meeting. Still unresolved was the question of the original complaint. LMSC top management requested substantiation of the charges but substantiation did not exist. The instigator of the complaint has since moved to another company.

The ensuing weeks found Agena C&C engineers at the plant seeking evidences of improvement at the operating level. Assurances of good intentions were received from all quarters within the company, but were coupled with explanations that nothing concrete could be done until LMSC top management should propagate written instructions to proceed. This sluggishness generated additional adverse reports up through the Air Force chain, and at subsequent IMSC-AFSSD meetings IMSC top management was reminded that results were of the essence. Finally, after the passage of 4 to 5 weeks actions began to appear. A task team was established by mid-April to carry out the program. It encountered some real difficulties: high reliability semiconductors required long procurement lead times, expeditious handling of failed equipment was a continuing source of attention, and there was a lot of residual loyalty of task team members to their functional organizations, a condition which for a time gravely diluted the authority of the task team leader. During the next 12 weeks we kept the total effort under close and continuous scrutiny, and were gratified to see a cohesive effort take shape, but were disappointed at the snail-like pace of inception.

6. Analyses and Schedule Difficulty: Meantime several analyses of the equipment were underway. One was a "worst case analysis" performed by IMSC R&E engineers. This analysis was primarily theoretical and included testing only of modules that were redesigned based on the theoretical analysis. Not all Programmer XVI Modules were included in the analysis. It was to be completed by June 30 but was three weeks late. A partial analysis was underway by engineers from Aerospace Corporation with whom the GATV program division had a contract for technical surveillance. This was restricted to pure analysis and covered only a few of the problem modules. The analysis of greatest importance and interest was the one conducted by Stanford Research Institute at Palo Alto, California. This analysis not only included some theoretical work but also did include actual testing of the Programmer XVI memory assembly. This SRI analysis turned up a number of deficiencies and led to the redesign of several modules in the equipment. Unfortunately this evaluation of actual flight-configuration equipment got underway too late for its full potential benefits to be realized. A copy of the SRI analysis is attached. It is necessary at this point to emphasize the following fact: Had the original design been attended with this level of care, analysis, and bread-board testing, the intensive, tight-schedule expensive, last-minute corrective effort would not have been required.

7. GATV C&C Improvement Results to Date: The equipment is demonstrably more resistant to interference, both conductive and electromagnetic and, although quantitative data has not been assembled, both IMSC and AF engineers feel that the manufacturing failure rate has improved markedly; that is, few modules are found to be operating out of specification after assembly. The schedule has not been slipped. The other day a IMSC executive remarked that the problem now is trying to explain why the original schedule had so much padding in it. Some changes remain to be made in subsequent vehicles, the value of these changes outweighing the disadvantages of configuration change and cost. Other changes are characterized as desirable but have not been scheduled for incorporation. Working against changes is the lateness of the effort. Many of our questions this spring were met with the answer, "That's being covered by our worst-case analysis." Question: "When can we see it?" Answer: "We're still working on it." The company's worse -case analysis had a publication date too far downstream to satisfy

the Air Force in that it was scheduled for publication too late for Air Force study. We could not get LMSC management to accelerate the work or the report, nor could we get the LMSC engineers to talk circuits freely. There was evidence they had bden cautioned about open discussions with the "blue-suiters." The philosophy seems to be: Hold the customer off at arms length. Minimize his contact with engineering; minimize his contact with manufacturing; minimize his contact with testing. This will minimize his knowledge of bad practices. The policy is never enunciated, simply praticed. Since a large number of unexplained failures at lower levels of assembly makes system reliability suspect even though the system may be operating correctly at the moment, the above philosophy, if it can be called that, clearly is not acceptable to the Air Force nor to any United States Space Program. May this experience prompt the military and civilian space programs to take a second look at hardware and its design, manufacturing and test histories. In addition may we remember that anlysis by itself is useless; it must be followed by appropriate improvement.

8. GATV First Vehicle Configuration Inspection and Acceptance: This began 10 May 1965 and occupied the ensuing three weeks. It was apparent immediately that the improvement program had not impacted the first vehicle. In the available time 285 discrepancies were found by the C&C configuration subcommittee. The committee estimated that potentially over 2000 such discrepancies could be documented and recorded were the time available. Our subcommittee noted with interest and relief that the acceptance team pronounced the vehicle unflightworthy.

9. Space Ground Link System: This system, designed and produced by Thompson-Ramo-Wooldridge is of interest to the office because it promises advantages in its volume, weight, power consumption, versatility, and mechanically-modular outer configuration. Preliminary discussions are underway with the program office.

2 Atch
1. Briefing Charts entitled "Critical Problems Associated with Gemini Agena Target Vehicle Command and Communications Subsystem (2 cys)
2. Analysis of Memory Assembly, Command Programmer XVI (Final Report) by Stanford Research Institute (2 cys)

AEROSPACE GROUND EQUIPMENT DIVISION
HISTORICAL DATA

1 Jan 1965 - 30 Jun 1965

1. All equipment modifications have been made and all new equipment provided under the provisions of the Agena Environmental Improvement Contract, AF 04(695)-715. This contract, period of performance 1 Dec 64 - 31 Jul 65, was negotiated for $581,580. As a part of this effort the contractor will submit, prior to 31 Aug, a report on a study of AGE problem areas and recommended solutions.

2. Technical and activation management assistance was provided to the Gemini Agena Target Vehicle (GATV) Division during this period in support of the Launch Complex 14, ETR conversion. A GATV vehicle on stand (VOS) capability was achieved on 8 July.

3. Lt Colonel Edwin A. Senkbeil was assigned as Chief, AGE Division effective 18 June 1965.

4. Proposed Titan III ILC/ITL facility. Review and comments were provided on Data Transmittals and the preliminary version of the Facility Contract End Item Specification TIII-34000. It has not been determined whether the Agena will be a requirement on the facility, so the basic consideration was to insure that the facility criteria and design could accommodate the Agena if it becomes a requirement. LMSC was provided coverage in March under CCNs 16 and 20 to review pertinent technical documents and attend interface meetings. A RFP was submitted to LMSC by the Martin Company for completion of Phase 1B of the program which involved definition of total Aerospace and facility requirements including complete specifications. The RFP was cancelled three weeks later due to the funding problems and lack of specific requirements.

5. Lt Cook was a member of the Source Selection Board established to select a contractor for the Program 461 Follow-On Program.

6. System Technique for Automatic Reconfiguration (STAR) was initiated on a test basis on Complex 75-3, Pad 4. STAR will accomplish the flight-to-flight engineering required for the launch control systems using a computer to compare the configuration to be flown with the past flown configuration. The output will be machine generated drawings and schematics from an input of the vehicle function interface pin list. It is estimated this system will save 25% - 35% in flight-to-flight engineering.

7. Contract AF 04(695)-821 (Improvement of Agena Aerospace Ground Equipment Power Supply System) was negotiated on 18 Jun 1965. The cost was $710,000 and the fee $54,670 for a total CPIF of $764,670. Preliminary go-ahead was given on 18 May 65 and the contract runs through 31 Jul 66. This contract will provide for AGE power supply reliability, reduce sneak circuits, reduce AGE power transients and sense vehicle power system faults. Modifications are made to Test Stations 1, 2, 3, the RACK Station and Vehicle Systems Test Complexes 5A, 6, 9, 11 and 12, all located at LMSC, Sunnyvale Calif. Similar modifications are being made at Launch Complexes 75-1, 2, PALC-2, 3 and PALC-2, 4, the Missile Assembly Building and the PALC-2 Technical Support Building, all located at Vandenberg AFB. Authority for this program is SP-12 letter, Proposed Improvements to the Agena AGE Power Supply System (C), dated 23 Dec 64.

8. Negotiations for ETR Launch Capability Contract (LCC) AF 04(695)-688 were completed on 17 Feb 65. The definitive contract was issued 3 May 65. The contract period was 1 Jan - 31 Dec 65. The negotiated price was $4,731,500 compared to $6,833,042, the original LMSC proposed price. The reduction in price was due to clarification of the requirements of the work statement and by eliminating the need for a high level of manpower by restricting major testing to a non-concurrent basis. The contract includes cost incentives only.

9. Schedule changes on the Gemini Program announced in April resulted in a potentially concurrent situation arising between major tests on the Vela Program and on the Gemini Program. A Fact Finding was held on 6 May 65 at ETR. It was determined a requirement for concurrent testing existed. A Supplemental Agreement to ETR Launch Capability Contract was negotiated 27 May 65 to provide capability to perform major tests on a concurrent basis during the months of June, July and August. Such concurrent testing capability costs $369,150.

10. There still remains a potential requirement to conduct major tests on a concurrent basis during the remainder of CY 1965, so the contractor has submitted a Letter Proposal to continue the manpower levels approved for June, July and August throughout the year. This proposal will be studied in July and, if the requirement exists, procurement action will be initiated in early August to insure continuity of effort.

11. Negotiations for WTR Launch Capability Contract (LCC) AF 04(695)-689 were completed in December 1964. The definitive contract was issued 10 May 1965. The Contract period was 1 Jan 65 through 31 Mar 66. The negotiated price was $30,768,488.

12. The request for proposal for the Follow-On ETR Launch Capability Contract was issued 30 Jun 1965.

HISTORICAL REPORT FOR THE AGENA CONFIGURATION CONTROL DIVISION

1 January 1965 through 30 June 1965 6 AUG 1965

1. **RESPONSIBILITY**.

a. The Agena Configuration Control Division was initially established by the Program Director, Agena Directorate, to administer configuration management of the Agena Vehicle. The Chief of the Configuration Control Division reports directly to the Program Director, and in addition to the initial Standard Agena configuration management responsibility, for the period of this report, was responsible for Gemini Agena configuration management (both vehicle and AGE), Burner II configuration management (both vehicle and AGE) and participated in the fact finding and initial application of configuration management on the Bell engine. Functional responsibility is governed by appropriate Air Force regulations, AFSC manuals, and other associated policy documents. The major governing document is AFSCM 375-1.

b. The Configuration Control Division is established by the Program Director as a separate division within the Agena Directorate.

2. **PERSONNEL**: As presented in previous reports manning of the Configuration Control Division, continues to be a major handicap. During the period of this report, two officers were transferred out of Space Systems Division and one out of the Configuration Control Division. One officer transferred into the Configuration Control Division. The unit manning document requirements remained the same for the period of the report. Manning affected the total efficiency of the Configuration Control Division for the period of this report, and is expected to continue the detrimental effect, until an appropriate decrease in program responsibility or increase in manning. The clerical problem is especially acute at the present time. Attachments 1, 2 and 3, relate to the manning problem.

3. **MAJOR POLICY AND PLANNING DEVELOPMENTS**.

a. **Policy**. Simply states, SSVAC policy is, to operate according to the appropriate regulations, manuals and specifications, with as few deviations as is feasibly possible. Configuration management (since it is only 3 years old by name, but many years old by principle), is a continual educating process both at the contractor's and in house. The Configuration Control Division continually revises and refines methods and procedures for maximum accuracy and effectiveness, and its staff is available at all times to answer questions regarding configuration management.

b. **Planning**. Major developments during the period of this report were:

(1) Planning of Gemini Agena First Article Configuration Inspection (FACI).

(2) Fact finding for procurement of the Bell rocket engine.

(3) Finalizing of the Gemini Agena specification program.

(4) Draft of AF 04(695)-722 contract, configuration management implementing instructions.

(5) Implementation of configuration management on the Burner II program:

(6) Establishment of configuration control program for the Gemini Agena program.

A brief summary of major planning aspects follow:

a. Planning of the Gemini Agena FACI's - The approach was to integrate configuration management, engineering and vehicle integration into configuration subcommittees. The approach worked very well on the vehicle FACI, by eliminating duplicate effort and inspecting the subsystem as an entity, rather than treating specifications, drawings, failure analysis, etc., individually. The major problem encountered was the actual hardware audit.

b. Fact Finding for Bell Engine Procurement. Once the decision was made to procure Agena engines directly, the Configuration Control Division participated in the pre-contract, fact finding trip. Bell Aerosystems Company's knowledge level on configuration management is very low. The June 1964 issue of AFSCM 375-1 is on this contract. A lengthy educating process is anticipated.

c. Finalizing the Gemini Agena Specification Program. The major problem encountered in planning the program was a continual practice by the contractor to quote full compliance on some specifications and standards and then, when full compliance was requested by the Air Force, indicating they had no intentions of complying without more money. The number of negotiations over deviations made the specification program especially cumbersome from a schedule viewpoint.

d. Draft of AF 04(695)-722 Contract, Configuration Management Implementing Instructions. The major planning improvement was elimination of all deviations to ANA Bulletin 445 and implementation of the configuration accounting exhibits from the 1 June 1964 issue of AFSCM 375-1.

e. Implementation of Burner II Configuration Management. This was the first program to have the 1 June 1964 issue of AFSCM 375-1 applied in total. FACI planning will be the next major step on this program.

f. Establishment of the Configuration Control Program for Gemini Agena. The most difficult aspect of the planning for this program was the third party (National Aeronautics and Space Administration (NASA)). The coordination on each Engineering Change Proposal decision is unwieldy but apparently necessary since NASA controls funding. Twenty (20) full hours were spent by the configuration management staff educating the various contractor personnel on aspects of the program.

4. PROBLEMS ENCOUNTERED IN PURSUIT OF MISSION OBJECTIVES: The major or critical problems associated with configuration management during the past 6 month period, fall into three general categories. Treated individually these categories are as follows:

a. Understanding: Configuration management is a relatively new subject. Many Air Force and contractor personnel are not familiar with the requirements of AFSCM 375-1 and equally unfamiliar with the procedural functions that support these requirements. During the period of this report, this problem resulted in personnel (both Air Force and contractor) other than configuration management staff making configuration management decisions. When configuration management is applied to new areas or contracts (such as Aerospace Ground Equipment (AGE), or the AF 04(695)-766 contract) the educating process by the Configuration Control Division is usually a lengthy task, comlicated by several factors, such as the contractor's internal organization, lack of standardized approach by separate divisions within a contractor's organization etc.

b. Communication: Stated simply, this getting working groups (such as specification writers, engineers, quality assurance etc.) to talk to each other, naturally reflects in configuration management inspections. At the Gemini Agena Vehicle FACI in May of this year, contractor personnel assumed their supervisor or another group was going to take care of their individual responsibility and the result was a failure (as a collective program effort) at FACI. Company management did not create a strong communication atmosphere and this severly hampered the Air Force configuration managers accomplishment of his required job.

c. Implementation: This would have to be classified as the most critical problem encountered during this reporting period. On the Gemini Agena Program it was discovered that the configuration management requirements for the Secondary Propulsion System (SPS) subcontract were inadequate and in error. When the contractor was questioned on in house coordination of this subcontract, it was discovered that no one in the contractor's configuration management organization participated in the implementation. On the Bell engine program, Air Force personnel other than configuration management gave the contractor configuration management implementing direction that was totally incorrect and would have been very costly if the direction had not been corrected by the Configuration Control Division before the contract was negotiated.

The above problem areas represent only a summary of problems but SSVAC has initiated the following steps to resolve them as soon as possible.

(1) All SSVAC staff members will answer any or all questions by either contractor or Air Force personnel concerning configuration management or know where to find the answer through continuing study of configuration management documentation and associated references.

(2) Work closely with the contractor in the implementation stage to insure that the configuration management effort is an required and will function effectively in support of a given program. The new AFSCM 375-1 has expanded the emphasis on the Government contractor relationship a great deal.

(3) Conduct briefings either in house or at the contractors to insure correct interpretation and therefore increased understanding in the application of configuration management.

(4) Standardize operational procedures within the Configuration Control Division to the maximum extent possible.

(5) Use comparison wherever possible to show increased effectiveness over other programs or past experience.

(6) Continually evaluate the manning requirements as related to the mission and request additional manning according to specifics not generalities. Continually evaluate methods of operation to obtain maximum efficiency with minimum manning.

5. CURRENT MISSION OBJECTIVES:

a. Standard Agena: The major effort has been in the configuration identification area. A study is being accomplished to streamline the specification program and make it more manageable. The LMSC drawing structure also needs revision. This study is scheduled for the period of the next historical report. Configuration accounting is still poor and attempts are being made to improve it but the manning limitation makes it a hit and run process.

b. **Gemini Agena:** As of the end of this report a transfer of responsibility was underway for the Gemini Agena Program Office (SSVAT) to take over their own configuration management. The objective is to have the change over complete during August 1965.

c. **BurnerII:** The major aspect of this program was the application of the new (1 June 1965) AFSCM 375-1. The specification review and approval cycle is complete. Present emphasis is on critical design reviews and FACI planning.

d. **Bell Engine:** This program also has the new AFSCM 375-1 on contract. Primary objective on this contract is to raise the knowledge level of Bell Aerosystems Company to a self supporting position.

e. **Miscellaneous Activity:** The Configuration Control Division participated in the review and approval of the T-III-X interface document. The division also provided inputs to the new AFSCM 375-1 Exhibit on interface. Because of its critical nature, interface documentation, must continue to hold a high priority on the configuration management objective list.

James L. Knight CAPT/USAF
For BASIL A. ORTOLIVO
Major, USAF
Chief, Configuration Control Div

[illegible]

SSVAC/Capt Kington/3337

Request for Position of File Clerk-Typist for Configuration Management Office (SSVAC)

SSVA (Capt Roshon)

1. The present manning of the Configuration Management Office calls for one clerical position. The title is; configuration control clerk. The job description by activities is listed below in two columns; first, what the job description calls for, and second the actual figures based on an evaluation for the past seven months.

	Job Description	Actual
Support CCB Activities	50%	* 70%
Typing	15%	* 30%
Mail Runs	10%	* 2%
Prepare Travel & Leave Orders	5%	* 15%
Safe Guard Classified	5%	5%
File Maintenance on Classified	5%	5%
Receive visitors & telephone Calls	5%	5%
Control of Drawing File	2½%	* 0%
Specification and Manual Maintenance	2½%	* 0%

* Indicates actual percentage in relation to present duties. Where factor is higher than called for efficiency factor for all areas decreased. Where factor is lower SSVAC staff members took on the additional job, because of clerk's inability (because of workload) to accomplish the task.

2. In requesting an additional position the following facts were considered.

a. The primary mission of the Configuration Management Division is the identification, control and status accounting of configurations of vehicles for which management responsibility rests with the Agena Directorate.

b. The primary results of most configuration management activities is documentation. Some examples are, letters, specifications, portions of work statements, implementation documents, records, engineering drawings and reports.

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AME (SIGNATURE)	Capt Kington				
ATE	10 Feb 65				

SSD FORM JUL 63 11 COORDINATION SHEET

Atch #1

c. Many of the above documents are maintained in the Configuration Management Division for reference purposes and use by other offices within the directorate and by using program personnel.

d. Since the Chief of the Configuration Management Division reports directly to the Program Director Agena Directorate, it is mandatory that the information maintained be of the highest quality and in an orderly, easily usable condition.

e. Since configuration management is a relatively new area of systems program management, many letters are written either to establish policy or provide interpretation. The low level of the contractors knowledge in this area has been very apparent in past months and response to current contractual requirements has been slow, therefor the amount of letters has been excessive.

f. All configuration management offices at SSD with programs the magnitude of the Agena Program (and in some cases smaller programs) have a minimum of two secretaries.

g. The major areas where additional effort is required are typing and filing.

h. The performance of the configuration control clerk has been outstanding in all aspects of the job description but the magnitude of the work does not fit the job description.

i. The job description was written and classified in April of 1964. At that time the only major program was Standard Agena and using program activity in configuration management was very low. Configuration management of AGE was nonexistent.

j. Presently the Configuration Management Division supports two major programs, and is in the process of placing AGE under configuration management. Two major new programs are in the work statement stage at the present time.

k. When one clerk attempts to support five staff members and the division chief in the activities referenced in (j), the time limitation is severe and creates a back-log in typing-filing and associated administrative duties.

l. In April this administrative back-log was approximately 3 months. Through concentrated personal effort the configuration control clerk has cut this to approximately 1 month but all efforts to bring it below this point have little or no effect due to the time limitation.

m. Whenever possible configuration management staff members assist the configuration control clerk but is is intuitively evident that this is a misapplication of time and ability.

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n. Captain Kington has revised or rewritten the configuration management SOP's to obtain maximum effectiveness based on minimum manning but internal procedures continue to be a problem in the typing and filing area.

o. Whenever a typing backlog exists priorities must be assigned to written communications thereby slowing down the overall communication response of the Configuration Management Division.

p. Whenever files are in a substandard or nonstandard condition they are hard to use (especially for personnel with less than intimate knowledge of their contents).

2. Configuration management by its very nature, identifying, controlling and accounting for various configurations turns out a lot of correspondence, receives a lot of reports and many times becomes involved with official correspondence of other offices within the directorate. The volume figures are approximately these:

Letters written per day (Average) 15
Reports distributed per month (Average) 20
Consolidated changes to Specifications distributed per month (Average) 30
Internal records changed per week (Average) 3
This give a total average of 40 documents created or handled per week.
Job responsibilities in this area would run an average of 50%.

3. File maintenance and preparation. This an area that has been badly neglected because of time limitations imposed by current clerical manning. Job responsibility would consist of seeing that folders were properly identified in accordance with the file maintenance plan, see that all folders were in proper order (there are folders other than specification folders), maintain control over the file to insure proper accounting for items removed and insure folders entered are in the correct order or position. Accomplish additional tasks concerning the files as directed by the configuration management officer in charge of internal procedures. The time factor for this portion of the job is 20%.

4. Maintain in an up to date status all reference documents used by the configuration management staff. This involves Military Specifications, Federal Specifications and any SSD directives or applicable documents. The time factor here is 5%. The volume factor is approximately 100 documents.

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FORM 11 COORDINATION SHEET

5. In requesting an additional position the best approach is to write a job description of what areas of the office operation need attention that are not receiving the required attention now.

a. SSVAC is the documentation center for the directorate. In line with this responsibility, there are two major areas that need immediate attention. For other areas see proposed job description.

(1) SSVAC has one full safe containing nothing but engineering drawings. These drawings are of little or no value to the engineers that must reference them because they are not filed chronologically and they are not up to date. Volume wise there are approximately 20,000 cards which require periodic revision to keep only the latest most correct information in the file for reference by Agena Directorate engineers. Job responsibility in this area would be to keep the files up to date (after first running them through the sorting machine to establish the initial order) revising them periodically as revisions come in, or new drawings are added to the file. Time factor would be 10%.

(2) SSVAC has one safe completely full and another safe two thirds full of Standard Agena specifications. These specifications are all contractual documents and are constantly being used by members of the SSVAC staff to perform the primary mission, and are continually referenced by other offices within the directorate in the performance of their individual jobs. The job responsibility here would be to standardize the working files so that they would be more usable and not require a lot of digging to find what you are looking for in a specification folder. After the initial effort this task would level out at about 15% of the job description. Volume wise there are approximately 160 specifications on Standard Agena alone. Gemini Agena will add at least 30 to this number and the new program which SSVAC is taking over at the present time will add at least 40 more. Again it must be emphasized that these specifications are always in a mobile state. They are either being used or going through change or revision action.

LAWRENCE S. NOLAN
Major, USAF
Chief, Configuration Management Div

1 Atch
Job Description

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NAME (SIGNATURE)					
DATE					

JOB DESCRIPTION TYPIST/FILE CLERK

1. General: This job is performed as a portion of the internal effort of the Agena Configuration Management Division. The primary responsibilities of the job are in the typing and filing area, however the job calls for a neat appearance, the ability to deal with people, a courteous manner, initiative and adaptability.

2. Specific Job Breakdown: (Duties and Responcibilities).

a. TYPING. Type from handwritten notes, rough drafts, or verbal comments of configuration management staff members. Establish and maintain a working knowledge of the types of correspondence that are prepared by the configuration management staff. Become familiar with the correspondence procedures utilized by the Agena Directorate. Establish and maintain a working knowledge of all aspects of a typing assignment, to include; addressee's, format, number of copies required, grammatical accuracy and signature blocks. 50%

b. FILING. Be responsible for the contents of all the configuration management files and maintain them in accordance with the Files Maintenance Plan. Will work closely with the configuration management officer in charge of internal procedures to standardize wherever possible. Will maintain control over all files by proper sign in and sign out procedures. Will be responsible for additions or changes to the files, and to individual folders as far as neatness, proper identification, and conformance to established procedures. Maintains files of documents classified to Secret and related material according to project concerned, content, or special instructions. Maintains an AF Form 310 File on all classified material, indicating identification data and file location. Insures proper safeguarding of classified documents by enforcing security procedures related to processing and filing of classified material. Frequently researches files to extract information required for project reports or correspondence. Screens files to withdraw obsolete information, downgrade classification, or complete records disposition according to directives. Types destruction lists and arranges for destruction in accordance with regulations. Maintains reading files. Will maintain the engineering drawing files in the correct order and make changes to the files as required. Will become familiar with recording documents, logs, etc., as to their relationship to the contents of the files. Maintain an awareness of the general content of the files to aid in quick reference to specific subjects (e.g. ECP's, specifications etc.). 35%

c. Receives visitors and telephone calls, and from a knowledge of assigned activities of personnel, refers callers to military officers assigned, or answers inquiries of a general non-policy nature, being tactful and courteous in all conversations; determines that information

Attachment #1

of a security nature is not discussed. Makes appointments for officers. Takes messages for officers in their absence. Places long distance calls. Escort visitors. 5%

d. Prepares travel and leave orders and insure that they are properly processed. Makes travel, hotel or VOQ reservations, and picks up tickets. Determines that security clearances are on file at all TDY points to be visited. Upon completion of TDY, prepares and processes travel vouchers for reimbursement. 5%

e. Be responsible for all appointment boards in the Configuration Management Division. Coordinate with SSVAC staff to insure timely, entry, revisions, or deletions to these boards. Assist configuration control clerk in maintaining status boards as required. 2½%

f. Be responsible for coordination of documents or correspondence within Space Systems Division. This will require individual to establish and maintain a knowledge of various office locations and maintain a general awareness of their primary function. 2½%

CONTROLS OVER WORK.

Works under the supervision of the division chief who makes initial assignments, and evaluates work for compliance with instructions, appearance and quality. Completed work receives spot check review. Guidelines AFSCM 375-1, ANA Bulletin 445, correspondence, filing and security manuals.

8 MAR 1965

SSVAC/Capt Kington/33378

SSVAC Operation (Impact of Disapproval of Additional Clerk Position)

SSVA (Capt Rozhon)

1. Presently the Configuration Management Division supports two major programs, and is in the process of placing AGE under configuration management. Two major new programs are in the work statement stage at the present time.

2. Whenever a typing backlog exists priorities must be assigned to written communications thereby slowing down the overall communication response of the Configuration Management Division.

3. When one clerk attempts to support five staff members and the division chief in the activities, the time limitation is severe and creates a backlog in typing-filing and associated administrative duties.

4. In April this administrative backlog was approximately 3 months. Through concentrated personal effort the configuration control clerk has cut this to approximately 1 month but all efforts to bring it below this point have little or no effect due to the time limitation.

LAWRENCE S. NOLAN
Major, USAF
Chief, Configuration Management Div

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E (SIGNATURE)	Capt Kington/vv				
	8 Mar 65				

FORM 11
JUL 62

COORDINATION SHEET

Atch #2

9 [illegible] 1965

SSVAC/Maj Nolan/33376

Impact of Losing Officer Position

SSVA (Capt Rozhon)

1. Withdrawal of the validated requirement for an additional officer position to support the Burner II Program will seriously impact the overall efficiency of this office.

2. Our present staffing provides adequate coverage for the two major programs, including the AGE for one, already under full Configuration Management in accordance with AFSC 375 series regulations. The requirement to support two additional programs, Burner II and P-50, without increase in manpower will effect a decrease in our surveillance and control of present programs and cause insufficient emphasis to be given to new programs in their early formulative time period. This deterioration in efficiency results from the added workload of establishing and tracking new configurations, and in controlling and documenting changes to hardware, drawings and specifications.

3. It will be impossible to give all programs the attention they should have if our manning remains the same.

LAWRENCE S. NOLAN
Major, USAF
Chief, Configuration Management Div.

SSVAC
Maj Nolan/iz
8 March 1965

Atch #3

UNCLASSIFIED 211

ROUTINE

FROM
SSD LOS ANGELES CALIF

TO
AFSC

Cy to:
SSVA/Col Nielsen
SSSS/Maj Morrison

UNCLAS SSG [illegible] OCT 65

PERSONAL FOR GEN L. I. DAVIS FROM GEN FUNK. REFERENCE GEN SCHRIEVER'S MESSAGE SCG-33677 SEP 65 TO THE CHIEF AND UNDER SECRETARY ON THE 2 SEP 65 THOR AGENA ACCIDENT AT VANDENBERG AFB AND MY MESSAGES SSG 10107 SEP 65 AND SSG 10110 OCT 65, SAME SUBJECT. IN VIEW OF GENERAL SCHRIEVER'S UNAVAILABILITY AND THE DELAY THAT HAS ALREADY ENSUED IN REPORTING OUR FINDINGS TO THE CHIEF AND UNDER SECRETARY, I SUGGEST YOU MAKE ARRANGEMENTS TO BRIEF GENERAL AUSTIN DAVIS, AND SUBJECT TO HIS APPROVAL, ADVISE THE CHIEF AND UNDER SECRETARY OF THE FINDINGS OF THE AD HOC COMMITTEE AND THE MISSILE ACCIDENT INVESTIGATING BOARD. PLEASE ADVISE TIME AND PLACE OF BRIEFING SO SSD CAN SEND REPRESENTATION.

DATE 20 OCT 1965

SYMBOL SSGA

TYPED NAME AND TITLE
Col J. L. Hamilton/Chief of Staff

PHONE [illegible] 1 1

SECURITY CLASSIFICATION
UNCLASSIFIED

SIGNATURE

TYPED NAME AND TITLE
BEN L. FUNK
Major General, USAF
Commander

DD FORM 173

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[illegible] Program 206-II Agena Launch Capability Contract
[illegible]

SSD (B/Gen Martin)

1. Following General Cooper's letter to you of 30 August 1965 on this subject, you met with and were briefed by Colonel Hudson and personnel of the Agena Directorate on 27 September 1965. I subsequently requested Colonel Hudson to set up a briefing to acquaint me with this problem and to give me your reactions to General Cooper's letter and the September briefing. I have just completed my review and I am very much concerned about this situation. I would like to express several thoughts I have regarding this issue.

2. Prior to 1962, Agena were contracted separately for launch operation services. It became a difficult task to manage these contracts and retain adequate control over the contractor's manpower and equipment expenditures. Programs were unable to identify and separate launch service costs between themselves, and as a result the contractor could have collected more than once for the same work. It was also a disadvantage to the Air Force in having to negotiate multiple contracts for the same Agena launch services. In 1961 a board of SSD officers studied the problem and recommended establishing a Consolidated Launch Capability Contract. This was accomplished in 1962 and since has proven to be very successful. Program costs are easily identified; management of the contractor's launch services effort is under better control; incentive contracts have been negotiated and, in general, this type contracting best protects the over-all interests of the Government. The Consolidated Launch Capability Contract continues to provide services for Agena using programs at VAFB. The latest launch complex loading schedule shows seven programs scheduled to use the existing Agena launch services. Three are NASA Programs and four are Air Force of which three are SAFSP (not including 206-II). [illegible] increase in programs and the associated increase in launch [illegible] the past successful operation of the Consolidated Launch Capability Contract. Just the opposite can be anticipated [illegible] manpower and equipment to support [illegible] should result in a decreased launch [illegible] to divorce itself from this [illegible] definitely a step in the wrong direction [illegible] best interest of the Government.

[illegible] understanding that the unique features of the "factory-to-pad" [illegible] constitute the primary justification for a separate 206-II launch contract. I do not agree that the Consolidated Launch Capability Contract is incompatible with this concept and, except for the [illegible] launch team, I believe it can best provide those services [illegible]. However, accepting this justification for the 206-II Program's separate contract, there appears to be some significant changes in the proposed approach since your September review. Although the "factory-to-pad" concept applies only to the 206-II, recent discussions with 206-II Program personnel indicate that certain functions of the 206-I Program are now also being considered for incorporation into the 206-II Contract. Also, it was first indicated that only a very small number of personnel were being considered for residence at Vandenberg AFB. It now seems that the number of resident personnel planned to support 206-II launch operations will be substantial. The 206-II Program personnel have always strongly denied any requirement for the Missile Assembly Building. However, there is now a work request in process to augment this facility to support the influx of additional 206-II personnel to be assigned to Vandenberg AFB.

4. For some time now the 206-II Program Office has been trying to define their requirements for services to be provided by the Consolidated Launch Capability Contract. In spite of completely cooperative joint 206-II/Agena meetings on the subject, no specific decisions have been made. I believe the difficulty of trying to split the functions between the two contracts is indicative of the future problems that may be anticipated. This difficulty is also responsible, I believe, for the trend toward more and more services being provided independently by the 206-II Contract to the point of complete autonomy.

5. Lack of firm decisions and definition by the 206-II Program Office has for some time been delaying preparations for negotiation of the Follow-On Consolidated Launch Capability Contract. Immediate resolution is required to avoid the necessity of issuing a letter contract, a practice strongly discouraged by higher headquarters.

6. I suggest that you and I meet at the earliest opportunity to discuss and resolve these problems.

SIGNED

[illegible]
[illegible]
Commander

HEADQUARTERS AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE ANDREWS AIR FORCE BASE
WASHINGTON, D.C. [illegible]

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Office of the Commander

22 November 1965

SSD (Maj Gen Funk)   AEDC (Brig Gen Gossick)

1. I have been briefed on the steps being taken to solve the problem which caused the failure of the first Gemini-Agena flight and the urgent actions which are needed to fly at the earliest possible date. NASA has assigned a priority to the Gemini-Agena over and above all other NASA tests at AEDC. This letter establishes a priority at AEDC above other Air Force tests. I expect the Commanders SSD and AEDC to take whatever action is necessary to accelerate this program, including the maximum use of overtime, multiple shifts, holiday and week end work. This includes using the same type of effort at AEDC to conclude LEM testing as authorized by NASA at the earliest possible date.

2. You will report to me any problems encountered which impede the maximum acceleration of this program. The Commander AEDC will appoint a responsible officer as the single point of contact through which SSD and the SSD contractor team will deal. His name and telephone number should be provided to SSD (SSV) as soon as possible.

3. You must recognize that since NASA has established an overriding priority in support of this program, that the total responsibility for successful pursuit of this project now rests squarely on the Air Force and in turn Systems Command. The Air Force team including the contractors must produce. I expect your personal attention to this matter in order to accelerate to the maximum and have the highest level of confidence in the success of the remainder of the Gemini-Agena flights.

B. A. SCHRIEVER
General, USAF
Commander

[redacted]

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ROUTINE

SSD LOS ANGELES CALIF

AFSC

UNCLASSIFIED SSG 10125 Nov 65

PERSONAL FOR GEN B A SCHRIEVER (SCG) FROM GEN B I FUNK. SUBJECT IS AGENA VEHICLE DELIVERY. FOR YOUR INFORMATION, TECHNICAL SPECIFICATION COMPLIANCE AND CONTRACTUAL PROBLEMS AT LMSC HAVE RESULTED IN AIR FORCE NON-ACCEPTANCE OF AGENA VEHICLES SINCE [illegible]. LMSC IS PRESENTLY DELINQUENT IN THE DELIVERY OF SIX AGENAS AND THE ADMINISTRATIVE CONTRACTING OFFICER HAS ISSUED A DELINQUENCY LETTER TO LMSC MANAGEMENT REQUESTING CURE ACTION. DUE TO PREVIOUS HEALTHY PRODUCTION AND STORAGE CONDITIONS, NO PROGRAM REQUIREMENTS HAVE YET BEEN IMPACTED ALTHOUGH NASA REQUIREMENTS FOR PAGEOS AND LUNAR ORBITER VEHICLES ARE IMMINENT. PROBLEMS INCLUDE NON-COMPLIANCE

22 NOV 1965

1 2

WILLIAM C. NIELSEN 32228
Colonel, USAF
Director, Agena
Deputy for Launch Vehicles

SIGNED

BEN I. FUNK
Major General, USAF
Commander

SSD LOS ANGELES CALIF

WITH SPECIFICATION REQUIREMENT FOR X-RAY INSPECTION OF SEMI-CONDUCTORS, EVIDENCE OF MOISTURE CONTAMINATED TRANSISTORS USED EXTENSIVELY IN AGENA EQUIPMENT, NON-COMPLIANCE WITH SPECIFICATIONS FOR STRUCTURAL TOLERANCES AND LMSC RELUCTANCE TO NEGOTIATE PROPER CONSIDERATION TO THE GOVERNMENT FOR NECESSARY WAIVERS GRANTED. I HAVE EXPRESSED MY CONCERN TO D J HAUGHTON AND SUGGESTED THAT HE PERSONALLY LOOK INTO THESE PROBLEMS. THE AGENA PROGRAM OFFICE IS WORKING CLOSELY WITH LMSC AND THE AFPR TO EFFECT AN EARLY RESOLUTION COMPATIBLE WITH THE INTERESTS OF THE AIR FORCE. I WILL KEEP YOU FURTHER ADVISED.

281

CONFIDENTIAL

DEPARTMENT OF THE AIR FORCE
[illegible]
AF UNIT POST OFFICE, LOS ANGELES, CALIFORNIA [illegible]

REPLY TO ATTN OF: SSVA

SUBJECT: Historical Report (U)

8 FEB 1966

TO: SSEH

1. (U) The Agena Directorate is responsible for the management and technical direction of contractors' efforts for the definition, design, production, modification, storage, logistic support, test and launch support of the Agena space vehicle for all using programs. This includes certain engineering and procurement support to specific programs. The Directorate provides Aerospace Ground Equipment engineering support and facilities activation for all using programs and is responsible for managing and directing the Agena launch services contracts for the Eastern and Western Test Ranges. The Directorate is also responsible for management and technical direction of contractors' efforts for definition, design, production, logistic support, test and launch support of the Burner II space vehicle. The Gemini Agena Target Vehicle responsibilities were broken out from the Agena Directorate and the Target Vehicle Division became a directorate on 16 Aug 65. Colonel William C. Nielsen is Agena Program Director and Lt Colonel Cecil E. Riddle is Deputy Director (see attached organizational chart).

2. ~~(C)~~ Since 1 July 1965, seventeen (17) Agena vehicles (2 SS-01A, 13 SS-01B, one S-01C and one Agena B) were launched. Current success ratio for SS-01B still stands at 100 percent.

3. (U) Eight new contracts were issued and one letter contract was definitized during this period. The total estimated value of 49 active contracts is 340 million dollars. The procurement breakout of Bell engines resulted in a saving of 1.4 million dollars. The RFPs for follow-on contracts were issued breaking out the Barnes Horizon Sensor and the Bell Velocity Meter. In addition nine orders were made against the BOA Contract. The two Gemini Contracts were transferred to the new Gemini Target Vehicle Directorate. A proposal for three additional Burner II vehicles was received from the Boeing Company.

4. (U) As a result of briefings to Dr. Albert C. Hall, then Deputy Director (Space) DDR&E, a tentative approval was received to proceed with the development of a new engine for the Agena to use storable

[illegible] ALS

propellants. Subsequently, the funds allotted to this development were withdrawn and all effort on this development was cancelled.

5. (U) As a follow-up to contractor proposals, submitted in the previous six month period, to upgrade the performance and reliability of the Agena and to make it a more useful vehicle for using programs, several developments were undertaken. Examples of these items are:

a. Guidance and control electronics redesign and repackaging. Currently the guidance and control switching and signal processing is incorporated in three units. This redesign will update and consolidate these units into a single unit.

b. Separation joint redesign effort is to reduce separation shock by at least a factor of four and to provide for containment of the by-products of the explosive separation.

c. The guidance converter has been a suspect unit in several in-flight problems and due to circumstances has been subjected to undesirable fluctuations in ground checkout voltages.

6. (U) As a result of the improved Quality Assurance Program instituted as outlined in previous reports, many piece part problems have been brought to light. These have caused serious perturbations in the production of Agenas. As a result, the contractor failed to meet delivery schedules on seven vehicles. Details of these problems are covered in the attached historical reports.

7. (U) With few minor exceptions, the Burner II Program has been proceeding according to schedule.

8. (U) Two programs, due to desire to institute a factory-to-pad concept, have withdrawn from the Agena launch services contract and are contracting direct with LMSC for most of the launch services. The Agena contract will continue to provide some common effort. This breakout, due to timing, has serious complications in finalizing the Western Test Range Agena Launch Services Contract.

9. (U) The attached reports contain detailed information on the activities of each Division within the Agena Directorate.

10. (U) This correspondence is classified confidential because it reflects the activities of classified programs.

Lt Col

for WILLIAM C. NIELSEN, Col, USAF
Director, Agena
Deputy for Launch Vehicles

7 Atchs
1. Organization Chart(U)
~~2. Burner II Rpt(C)~~
3. Configuration Control Rpt(U)
4. Engineering Rpt(U)
5. AGE Rpt(C)
6. Procurement Rpt(U)
7. Requirements & Prog Rpt(C)

AGENA DIRECTORATE (SSVA)

Director	Col William Nielsen
Deputy Director	Lt Col Cecil Riddle
Secretary	Mrs Betty Miladin
Admin Asst	Mrs Ione Zimmer
	X 32228, 33280

BURNER II DIVISION (SSVAB)

Chief	Col Jean Goppert
	Maj Paul Hebert
	Maj Keith Kinsey
	Maj Donald Meadows
SAC Liaison-	Capt Robert Cebulski
	Lt Patricia Longworth
	Mr James Turk
Clk Typist,	Miss Sharon Crisp
	X32305, 31447

CONFIG MANAGEMENT DIVISION (SSVAC)

Chief	Maj James Martin
	Capt James Kington
	Lt Joseph Morgan
	Mr F. O. Phillips
Conf Clk	Mrs Vera Wells
Clk Steno	Miss Marcia Carlblom

S-01A AGE DIVISION (SSVAG)

Chief	LtCol Edwin [illegible]
Clk Steno	Mrs Joyce Stone
	X33284
	Maj Elmer Davis
	Maj Robert Wells
	Capt Norman Lee
	Capt Ernest Rousseau
	Lt Raymond Cook
	Lt Stanley Martin
Clk Steno	Mrs Joanna Lynn
	X33364

VEHICLE ENGINEERING DIV (SSVAE)

Chief	LtCol Wm Greenfield
Secretary	Miss Nettie Moss
	X 31616

Electronics Branch (SSVAE-1)

Chief	Maj William Gallup
	Capt Donald Hirsh
	Capt Robert Dempsey
	Capt Richard Cronquist
Clk Typist	Miss Victoria Sanchez
	X 33418
	Maj Richard Myers
	Capt Hans Einstein
	~~Lt George [illegible]~~
	Lt Lawrence Kikuta
	Lt Richard Bergmann
Clk Typist	Mrs Lorene Dorman
	X 33410

Astro Vehicle Branch (SSVAE-2)

Chief	Maj John Gibbons
	Maj Allen Poor
	Capt Donald Mitchell
	Capt Philip Merrill
	X 33312
	Maj George Watts
	Lt Edgar McKinney
	X 33282

PROCUREMENT DIVISION (SSVAK

Chief	LtCol Stanley Nelson
C.O.	Mr Helmut Becker
	Mr Gene Stewart
	Mr Anthony Bogart
	Mr Robert Fulcher
	Mr Dana McEnroe
	Mrs Jane Costello
Clerk	Mrs Aileen Torrenc
Clerk	Mrs Margaret Beave
Clk Typ	Mrs Joyrice Newton
	X 33404

REQUIREMENTS & PROG DIVISION (SSVAR)

Chief	Lt Col Wm Jones
	Maj Robert Crawford
	Capt Terence O'Rourk
	Lt John Stanton
	Lt Frank Tubbesing
Sec(Typ)	Mrs Jewel Nelson
	X 31507
	Maj Wm Bell
	Capt George Sloan
	X 33280

Atch 1

[illegible]

1. Mission - The mission of the Agena Configuration Management Division (SSVAC) is to apply the methods of Configuration Management to the Agena Space Vehicle Program with as few deviations as feasible. SSVAC also supports the Gemini Agena Target Vehicle (GATV) program and the Burner II program.

2. Personnel - Maj James Martin, formerly Chief of Thor Configuration Management office, succeeded Maj Basil Ortolivo, who went to the Manned Orbiting Laboratory (MOL) program, as chief of SSVAC. Miss Marcia Carlblom joined as a second secretary. Majors William Smith and Kimerlee Bradford left SSVAC as the GATV program broke out of the Agena Directorate.

3. Activities - SSVAC attended two First Article Configuration Inspections (FACI) at Cape Kennedy in support of the GATV program. The initial Hanger E FACI was a failure on the part of the contractor. Later the hanger was reinspected and found to be marginally satisfactory. The Merrit Island Launch Area (MILA) FACI was satisfactory once the squawks were resolved. A Burner II FACI of the Reaction Control Subsystem Servicing Equipment was supported. The contractor had done a satisfactory job. There were no standard Agena FACIs in this period. 83 Engineering Change Proposals (ECPs) were acted on during the report period, 226 changes to the Agena specifications were accomplished. Negotiations were conducted on the Statement of Work for the AF 04(695)-722 follow-on contract, and meetings were held to update and streamline the implementing instructions.

4. Significant Events - The GATV program broke out of the Agena Directorate and formed another Systems Program Office (SPO), SSVAT. This event decreased the workload on SSVAC but transferred two officers in the process. A decision was made to buy the Agena rocket engines directly from the engine builder. This created many problems - educating another contractor not familiar with AFSCM 375-1, and becoming familiar with yet another system of engineering management, specification "trees", and drawing structures. It is also being considered whether to buy the velocity meter and horizon sensor directly also. This would give SSVAC two more contractors and the previously mentioned attendent problems.

JAMES C. MARTIN, Major, USAF
Chief, Configuration Control Div.
Agena Directorate

HISTORICAL REPORT
1 JULY 1965 - 31 DECEMBER 1965
ENGINEERING MANAGEMENT OFFICE
(SSTAE-EMO)

1. Planning Developments.- Toward the end of the reporting period, it became evident to the chief of the Engineering Division that a single focal point was needed for the division's administration and engineering management functions. On 10 December 1965, Lt Col Greenfield notified his personnel that he had assigned responsibility for the division's collective administrative and engineering management responsibilities to the newly-established position of "Engineering Management Officer" (EMO), in order to "...permit each of you to concentrate your full effort and attention to the more immediate engineering demands of your position." He appointed Capt. H. Einstein to the position of EMO. Lt Col Greenfield's concept of operation for the EMO was that he would function exclusively as a service organization, without command authority; that he would be at the disposal of each branch chief, section head, and equipment engineer for assistance in common administrative and managerial matters; and that the EMO would identified to external organizations as the division's point of contact for all administrative and management matters not specifically within the purview of any one individual or group within the division.

2. Major Problems Encountered. - The first, and still the primary, major problem confronting the EMO was the problem which lead to his establishment in the first place: How to unclog the communications channels between the sources of management information and the decision-makers who need that data. Prior to the establishment of an EMO function, decision-makers on both technical and managerial level were characteristically being constrained in their decision-making capabilities by data which was unavailable, much too late, inadequate, unreliable, or mischanneled. The first undertaking of the EMO, therefore, was to attempt to identify which informational elements were needed by whom, when, and in what form. The next step was to analyze the procedures required to accelerate the transmission of required data to its intended users, and to retard or divert the transmission of extraneous, redundant, or unusable data to division personnel. In electronic terms, the task reduced to the problem of simultaneous signal amplification and noise suppression. The techniques applied to that problem were basic systems analysis and information theory methods, and still constituted the primary activity of the EMO at the close of the reporting period.

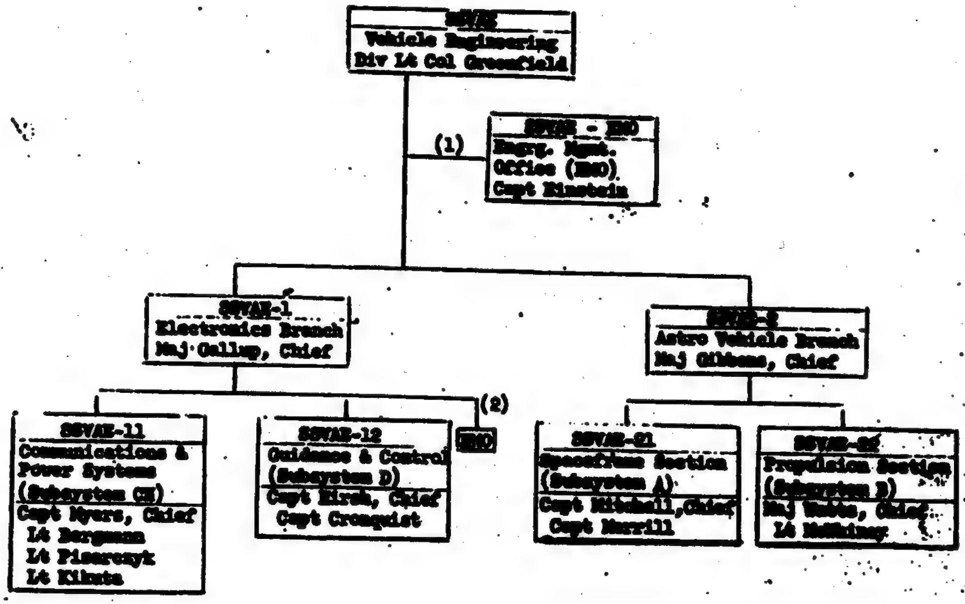
3. Major Accomplishments. - At the close of the present reporting period, the major accomplishment which can be related to the EMO function of this division was (1) the recognition of the need for better managerial controls and (2) initiation of positive action to establish those controls. This recognition, which is acknowledged almost to the point of institutionalization in both industry and at directorate or SPO level, has not yet permeated the UMD structure at divisional level.

ITEM 4

4. Organizational Changes. - Although the inertia of the UMD structure for the Engineering Division precluded a rapid "formal" restructuring of the division's organization in order to permit activation of the EMO, a functional restructuring was directed by Lt Col Greenfield along the lines of the attached functional organization chart.

Atch
Organization Chart

SSVAE ORGANIZATION



NOTES:

(1) Functional Line
(2) Administrative Line

ATCH 1

HISTORICAL REPORT
1 July 1965 - 31 December 1965
Subsystem CH
(SSVAE-11)

1. PERSONNEL AND ORGANIZATION

Subsystems C, Electrical Power, and H, Communications and Control, merged on 27 November 1965, becoming Subsystem CH, Communications and Power Systems. This followed the forty percent reduction in staff from seven engineers to four. Current status:

Name	Function	Auth Grade/Grade	Duty Req AFSC/AFSC
R.L. Myers	Sr. Project Officer	Maj /Maj	2821/2825
R.G. Bergmann*	Project Officer	1stLt/Capt	2825/2825
G.R. Pisarczyk	Project Officer	1stLt/Capt	2821/2825
L.M. Kikuta	Project Officer	2ndLt/Capt	2821/2825

Losses:

Name	Duty Grade/AFSC	Lost To
T.D. Tedrick	Capt/2821	"Return to Cockpit"
D.L. Hirst	Capt/2821	SSVT Directorate
R.L. Bush	1stLt/2895	AFIT, PCS

*At Air University Sep, Oct, Nov, Dec, 1965

2. GEMINI AGENA TARGET VEHICLE (GATV) COMMUNICATIONS AND CONTROL EQUIPMENT IMPROVEMENTS

(Reference: Preceding report, para 5 through 8, covering the large number of unanalyzed communications and control electronics failures, the resulting phenomenal cost of scrap and rework as well as dubious reliability, the informal investigation by AFSSD engineers, inertia and resistance by company management, unsubstantiated charges against the investigators, the top-level AF-LMSC meeting of 23 Feb 65, company promises of corrective action, slow implementation, preoccupation with contractual coverage, eventual formation of the task team, three separate engineering analyses and their limitations, and lessons learned.)

a. TASK FORCE ACTIVITY - That sweaty little band of action-and-results men had its hands full. It was charged with, among other things: Procurement expediting of the needed electronic parts, maintaining the flow of failed-equipment processing, handling the resolution of the 833 squawks (discrepancy forms) we had written on vehicle 5001, and incorporating the redesigns. In the preceding report, we have indicated briefly how the Task Team leader, J. S. Jaworski, was being undercut in-house by giving him responsibility without authority. Perhaps it was felt that a success by his Task Team would be an indictment of the company's past efforts and organizational

Crowded working conditions, piles of unmarked and/or obsolete drawings, specs, and test procedures, complete absence of test data, unavailability of Urgent Action Surveys (UAS's) and UAS Final Reports, incorrect or missing parts lists and assembly "trees", incomplete books of Failed Equipment Reports, and so on. We had an excellent working relationship with the entire Task Team, so we went to them. They heard our opinion of the previous efforts, concurred, and assured us this one would be done right. To stiffen their resolve, we made this announcement:

> "We will ticket and book the entire FACI team for the ten-thirty flight. Lt Caldwell, our advance man, will arrive before nine and take an hour to check the following (list similar to above). If he's happy by ten, the team will be up here and inspecting by noon. If he's not happy by ten, he'll return, and we'll notify you through channels you're not ready."

Thus galvanized, they came through. Best FACI we've seen so far. Traceable corrective actions, readable documentation, applicable revisions, full failure history, large-scale equipment tree, legible copies of trouble-shooting logs, etc. Their efficiency did embarrass the company however, since it tended to increase the total number of discrepancies accessible to the inspection team.

e. EQUIPMENT INCOMPATIBILITIES - Some of the most dangerous discrepancies, aside from unexplained failure reports, were incompatibilities between modules in the Command Programmer XVI where the output signal level and/or duration specified for a "driving" module conflicted with the input signal level and/or duration specified for the "driven" module. These were first detected by Lt. R. G. Bergmann who was disturbed by the lack of a top-level schematic drawing for this unit, and had started wondering what design "crimes" might have been prevented with a top-level schematic. On the FACI of vehicle 5001 to find a way to trace module interconnections, he had to cross-refer to five levels of documentation, a system which discourages good design and design-checking. It took him two days but when he finished he had five documented cases of incompatibility and estimated that perhaps another dozen or more existed. These are identifiable in the AFPRO/LMSC files by the marks H-265, H-266, H-267, H-26[illegible], H-26[illegible]. Aerospace Corporation's electrical engineers have adopted the [illegible] [illegible] on subsequent GATV acceptances and turned up some more cases.

The company was as appalled as we were and promised to clear this up quickly. Six months later, in late November, an acquaintance in the company tipped us that the effort still was not finished.

f. WORST CASE ANALYSIS PUBLISHED - (Reference preceding historical report, para 7.) This was promised 30 June for USAF review and action. It was published 3 September as LMSC Summary Report C-83-65-2, and in our hands still later. By that time any decision by us to redirect the company would result in a schedule slippage affecting the entire Gemini program. We realized this, and the company knew we knew it. The report reads (sample from first paragraph: "An investigation was initiated by LMSC engineers...") as if problem recognition and action originated in-house (not so) and proceeded in calm, intelligent fashion (not so) to completely solve the problem (not so). (When time permits, we hope to place into the record the curious story of the Logic Multivibrator Module.) Shortly before publication, a friend inside the company had bootlegged to us a copy of the working draft. It had pages five and six snipped off. He said he had scanned it and told management to expect a "reaction" from USAF if these portions were presented. We asked him what they were, and he described them in this language, "Page five is a whitewash of the 2N2102 transistor, and page six says there haven't been any misapplications or overstressing of parts in our designs."

g. MISCELLANY - By September our GATV Division had been augmented with more engineers, separated from our directorate, and raised to directorate status. We turned our attentions and energies to Agena Vehicle problems. We have responded to requests for assistance since then, but have lost the previous close contact with GATV's day-to-day electronics engineering problems. The lessons learned cost millions of dollars, and deserve recording. Their first shot, GT-6 (Vehicle 5002), fell into the Atlantic before tens of millions of television viewers and radio listeners. At first, we thought the Command System had done it. Telemetry indicated Propulsion System explosion.

3. TYPE XIV BATTERY

A contract for the Type XIV Battery Phase I development was negotiated in September 1965. The Type XIV battery is a high-energy zinc-oxygen battery system which will be installed as an optional kit in the SS-01B vehicle. The Phase I effort was limited to cell development and testing, battery case design, battery studies and systems integration studies which included integration, accomodation and optimization.

The cells tested in the cell performance matrix failed to deliver the capacity required by the specification. The problems seem to be in the fabrication technique and the process control of the cells. The basic electrochemical design appears to be satisfactory. Cell test data indicate that capacity greater than 825 ampere-hours can be achieved. Detailed fabrication process variables have been identified and proper control techniques are being investigated.

4. TYPE IH PRIMARY BATTERY

The program plan to modify the Type IF battery was approved on 30 September 1965. The IH battery will have the same performance characteristics as the IF battery. The modification will enable the battery to be installed in the side bay and as an optional UPA kit. Additional features include an internal temperature sensor and mounting provisions for a current sensor.

5. TYPE IX A CONVERTER

The design and development testing of the Type IXA converter was completed in November 1965. The test results reflect a significant increase in performance. Qualification testing should be completed by the end of February 1966. This converter will replace the present Type IX converter on the guidance module by April 1966.

6. BURNER II DESIGN REVIEW

On 30 June and 1 July, two of our electrical engineering officers participated in a critical design review at Boeing Seattle, on the Airborne Data System for the Burner II Satellite; and reported that vendor qualification data and test results were not received by BAC in most cases, not available for AFSSD review in other cases, and incomplete. Vendors had not been caused to submit their acceptance test procedures to BAC for review - also unavailable for AFSSD review. The vendor quality control procedures had not been submitted to BAC for review and BAC signoff, although we were assured BAC will do this. No BAC in-house receiving inspection/acceptance test procedures were established to date, with uncertainty as to how thorough and complete they might be when eventually produced. No BAC plans or test procedures were presented for items that require qualification or partial qualification testing by Boeing. Electromagnetic Interference data on vendor items was incomplete, and BAC's detailed EMI testing plans were not available for review. There appeared to be reluctance on the part of BAC to commit to doing what we would consider proper engineering and qualification testing on BAC-built items such as Signal Conditioner and Antennas. They concluded therefore that a follow-up design review would be necessary when qualification data and EMI data was available and properly reviewed by BAC. BAC should also present for AFSSD review their acceptance testing plans/procedures. They concluded further that AFSSD is essentially constrained to accept the "good faith" of BAC in delivering a qualified Airborne Data System, since the specifications impose few specific requirements on Boeing.

7. PROGRAM PLANS NOTES

Significant completions under the -695 Study Contract include:

a. Development of a simplified and ruggedized Command Destruct Receiver. This included repackaging the antenna mount on the RF filter to eliminate wiring and reduce energy loss.

b. Requalification of the Telemetry Commutator after substituting a Japanese micromotor with revolving orthogonal brushes for the American motors which tended to stick or fail to start after hours of operation.

c. Junction Box EMI Investigation - A study of electromagnetic interference reduction techniques were investigated for a typical junction box.

9. PREVARICATION AMONG PARTS PRODUCERS

In the past six months we've caught two of the largest U.S. semiconductor manufacturers in lies:

Manufacturer "A" replied to an LMSC inquiry on an integrated circuit problem that thermocompression ball bonding of leads had never given difficulty. Disclaimed responsibility. His letter to LMSC is dated 6 July 65. Simultaneously the schedule for Session 16B of the IEEE Convention was filling up with papers from Autonetics discussing just such a problem with guess who's integrated circuits. His. Some frantic backpedalling ensued. Ref: Subsystem H Report of 3 Sep 1965.

Manufacturer "B", also a major power in semiconductor manufacture, trapped his corporate self when he boldly but erroneously claimed minimization of moisture in a N_2 transistor capping chamber. In his office we interviewed one of his shop people and while covering the same ground for the fourth time were astounded to hear about a minimum level of moisture - 75 parts per million. Seems the men in the shop were economizing on nitrogen by allowing the moisture content to hover near the 120 parts per million "danger" point, and minimizing the expenditure of N_2 for chamber flushing. Penny-wise. That's only the first half of the story. Rest of it available on request. Reference Subsystem H Report of 3 Dec 1965.

MORAL: Don't believe everything you're told. Don't believe something just because it's been put into print. Don't believe something just because everyone else does. If enough is at stake (dollars, time, space equipment reliability) take the "Missouri" view of it. Verify it. Make him bring out the data. Demand to see the original scratchpad data. Go through it. Invest a little time and effort. Two times out of ten you'll uncover a mess. Resign yourself to looking foolish the other eight times. It's part of the job.

10. AGGRESSIVE RELIABILITY ENGINEERING

Our idea of a really good electronics reliability program involves much more than cautious design, piece-part estimates (they assume perfect workmanship and full system compatibility) analysis of flight result, and generation of reports. We want each - we mean each- manufacturing failure analyzed and corrective action taken. Preventive reliability efforts are better than curative reliability efforts. Someone has reminded us that such an effort is self-defeating since it involves heavy costs at first to produce rather intangible results, and after it has dropped the failure rate it looks still more expensive, even superfluous. That's true, but since 5002 swan dived on 25 October the preventive-measures approach is gaining converts. Firemen have understood this thing for a long time.

One of the first questions always should be, is this (defective) item part of my spacesystem? This is easier to ask than answer. A given semiconductor may be markedted under ten or more manufacturer parts numbers depending on variations in its performance curve, and each of these may be bough under three or more buyer's part numbers depending on the screening specifications. You may think you have only sixteen dangerous transistors in your system. The next day its three-hundred, retrofit is needed, launches are imminent. Reference Subsystem H report of 30 Dec. 1965 on traceability; and how lack of it has hurt us.

Contractors if left unattended will spend too much time determining the exact physics-of-failure, and not enough time laying out a course lof action, parts substitution, selective retrofit, kluging-up some redundancy, etc. Get in there and keep tab on his effort. Don't be hesitant to say, "Yes, but what is your recommendation for action?"

11. ON MORALITY AND CONTROVERSY INSIDE THE SPACE INDUSTRY

From time to time our experiences almost tempt us to the idea that Aerospace contractors are less than scrupulously honest. Actually we take view that if we were in the white shirt, sober tie, and contractual habit of thought, and they in the blue uniform under the oath of office, the situation might be much the same. We have made many frienships at the contractor's plant. It's just that their motives differ from ours. We have the money. They have the design staff and fabrication facilities. Soon they will have the money, and we will have - - well, exactly what we will have is the question every day.

There are indication that LMSC is not the only contractor with a loose operation. Last July two of us reported on another contractor's design review (paragraph six, above). Also, people have told us, "My God, you should see things at (GD, Boeing, Martin, Douglas, Northrop)."

A friend has cautioned us that we tell too much in our history and activity reports. We don't think so. We want to alert management and provide some useful cross-talk to once and future colleagues.

The AFSSD Historian visited us last year and told us our section's history was the only one in the entire Space Systems Division to admit and describe controversy with a contractor.

That's incredible.

HISTORICAL REPORT
1 July 1965 - 31 December 1965
SUBSYSTEM D
SSVAE-12

1. New Concepts - Contracts have been awarded to the Belock Instrument Corporation for the development of a "Solid State Horizon Scanning Technique" and to Quantic Industries for the development of a "High Accuracy Horizon Sensor System."

2. G&C Electronics - In November LMSC submitted their proposal for the Guidance & Control Electronics Package. The G&C Electronics consists of the Flight Control Electronics Module, the Signal Integration Module and the Program Module. These three units will replace the Flight Control Electronics Package, the Flight Control J-Box and Patch Panel, the Guidance J-Box and various Program J-Boxes. The new combination will have approximately half the weight and volume of its predecessors and will be relocated on the rear of the Guidance Module, thus creating more than one cubic foot of additional usable space in the forward rack. Preliminary studies have begun under Program Plan 253 with final contract negotiations scheduled for the 1st Quarter of 1966. The first production units will be available by the 3rd Quarter of 1967.

3. Inertial Reference Package

The Massachusetts Institute of Technology has been contracted to design, develop and build a prototype of an improved low drift I.R.P. Upon its completion a contract will be awarded for the production of the units. The first units will be available by the 3rd Quarter of 1967.

4. DVM IIA Velocity Meter

Bell Aerosystems Company has been chosen as prime contractor to develop and produce the Bell Digital Velocity Meter (DVM) Mod IIA. This system will be a repackaged version of the DVM III, which has been successfully flown on six occasions by other programs. It is smaller, lighter and more accurate than the prsent Mod II. Development is expected to begin in April 1966 with the first production unit scheduled to be available by April 1967.

5. Sequence Timer

Redesign of the Sequence Timer began in September with the design of an improved switch. It was soon realized that the effort would cost nearly as much as the development of a new electronic timer, and work was stopped. LMSC was then redirected to continue work only on the improved switch as an interim fix and to survey the industry for a manufacturer capable of building a solid state timer to meet Agena requirements. To date the new switch has demonstrated a lower contact resistance as desired, but it too, has experienced the same type of random failure as the previous unit. The prime suspected cause is contamination, and since the switch is not a sealed unit there is some doubt as to its possible elimination. The switch is now under study to determine the type and means of the contamination. Development of a solid state timer is expected to begin in the 2nd or 3rd Quarter of 1966.

6. X-Ray Problem

During an audit of the Di/An Electronics facility, it was discovered that a large number of the semi-conductor piece-part x-rays were unreadable. It was further found that some of the laboratories performing the x-ray services were not qualified by LMSC. Since the laboratories had been used by both Bell Aerosystems and Di/An, four Agena components immediately became suspect. These were the Velocity Meter Electronics and Electronic Engine Gate made by BAC, Buffalo plant; and the Velocity Meter Accelerometer made by BAC, Cleveland plant; and the Di/An Velocity Meter Counter. The decision was made to retrofit where possible, replace units which could not be retrofited, and to sweep and screen stock immediately. Due to the completeness of piece-part records kept by BAC Avionics Division, it was possible to locate and replace all suspect parts of the V/M Electronics and Accelerometers. The Engine Gates, of which there were five, were replaced. The Di/An Counter, being of modular construction could not be retrofited and would have to be replaced. Because of the fine test and performance history of the unit it was decided to fly the present units until replacements were available. The X-Ray laboratories in question have been either qualified by LMSC training or eliminated from future consideration.

7. Transistor Dew Point Problem

During the failure analysis of an LS 8488 transistor it was found that, at dew point temperatures, the collector to base leakage (I_{cbo}) was far above specification limits. Examination of similar parts in stock revealed that the condition was widespread among a number of similar transistors (Fairchild 2N 1131, 2N 1132, and 2N 722; all of mesa-type construction). The decision was made to screen the stock and eliminate all suspecttransistors, retrofit all components utilizing the parts, and to select and qualify a replacement part of the newer planer construction with the same performance parameters. The immediate interim fix was to replace all suspect transistors with similar parts which had been screened. The most logical explanation of the condition was a short resulting from moisture within the transistor, although an inspection of the vendor's facility did not support this belief. To prevent possible reoccurrence, all future circuit designs will incorporate planar type transistors which will be thoroughly tested at the dew point temperatures.

8. **PERSONNEL**

The Guidance & Control Subsystem lost the 2nd of its five authorized personnel when Major Gallup was given the position of Chief of the Electronics Branch. A 3rd member is due to transfer in January 1966. This will leave the subsystem with two captains to fill the positions of one major and four captains, at a time when a number of new developments which will require close monitoring are scheduled to begin.

HISTORICAL REPORT
1 July 1965 - 31 December 1965
Subsystem A
SSVAE-21

1. Titan IIIX/Agena - As noted in the previous report, a booster adapter design for the Titan/Agena combination has been initiated. This design is now complete and a portion of the static structural tests of the unit have been accomplished. These tests are being conducted by the Martin Company at Denver, Colorado, and include the Titan IIIX forward section as well as the booster adapter.

The most severe static structural tests were completed in December 1965. Simulated acceleration and air loads were applied to the structure during the tests. The stresses produced by these loads did not exceed the design stresses. A visual inspection of the adapter also revealed that it was not damaged by the tests. The static structural qualification tests will be completed in early 1966.

2. Zipcord Program - Lockheed Missiles and Space Company has been funded to develop and qualify a zipcord separation joint for the Agena vehicle. The purpose of this effort is to eliminate the particle contamination and reduce the longitudinal shock produced by the existing primacord separation joint. Development tests of promising zipcord joint designs will be initiated in early 1966.

3. Plumbing Improvement Program - In an effort to reduce separable connector leakage and failure problems, a program to qualify the Wiggins "DL" nut and sleeve was initiated at Lockheed Missiles and Space Company. An earlier analysis of this separable connector indicated that it is superior to the "AN" connectors now used.

Sealing, torque retention, and flexure tests of the "AN" and "DL" fittings were started in late 1965. These tests will be completed February 1966. At that time an analysis of the test results will be made to determine if the "DL" connector can be qualified for use in place of the "AN" type fitting.

4. Lockalloy Evaluation - In order to reduce vehicle inert weight through use of an efficient structural material, studies of a beryllium-aluminum alloy (lockalloy) have been initiated. This material combines some of the advantages of the components of the alloy. Like beryllium, the alloy has high strength; however, unlike pure beryllium, it has good fabrication characteristics. Assistance of Aerospace Corporation personnel has been obtained for the study of lockalloy. They are presently analyzing various portions of the Agena structure to determine if lockalloy would provide a lower weight vehicle than the materials presently used.

5. Structural and Thermal Investigations - A study of the effects of high angle of attack ("dog-leg") trajectories was completed at Lockheed. This effort showed that the structural capability of the Agena booster adapter and aft tank skirt are considerably reduced by the asymmetric heating which occurs during dog leg trajectories.

Atch 4

The results of the foregoing study were based on a limited amount of experimental data. Also, theoretical analysis of the stresses produced by asymmetric heating is quite difficult. As a result, the accuracy of the results was not considered to be high; however, plans to strengthen the booster adapter and aft tank skirt were initiated in order to prevent possible flight failures.

To obtain the necessary data to determine the effects of asymmetric heating, a second program has been started at Lockheed. This effort will consist of wind tunnel and model structural tests. The resulting information will be used to accurately predict the structural capability of the Agena when it is flown at high angles of attack.

HISTORICAL REPORT
1 July 1965 - 31 December 1965
Subsystem B
SSVAE-22

1. USAF YLR81-BA-11 Rocket Engines - The AF 04(695)-766 contract, to procure these engines directly from Bell Aerosystems Company, was negotiated. The first engine (S/N 679) was delivered as GFE in July of 1965. At the end of the year, 17 of the 55 engines to be produced on the contract had been delivered to the government and subsequently furnished to LMSC. As yet, none of the government-procured engines have flown.

During the last half of 1965, the YLR81-BA-11 engines maintained their excellent flight record. Out of the 16 engines flown, (15 on Agena D's and one on an Agena B) one exhibited a minor performance anomaly; however, there were no mission failures as a result of any engine deficiencies.

2. USAF XLR81-BA-13 Rocket Engines - The last two of the six flight engines were delivered on the AF 04(695)-766 contract during October of 1965.

The flight verification program was completed on the oxidizer gas generator solenoid valve with satisfactory results.

Unfortunately, the first flight test of this engine, on Gemini Agena Target Vehicle 5002, in October 1965, ended in total failure. The fuel lead into the thrust chamber at start-up (the YLR81-BA-11 has an oxidizer lead due to a different valve opening sequence) was blamed for causing an unexpectedly hard ignition, or ignition upstream of the injector. Resulting damage to the engine caused it to shutdown with subsequent vehicle destruction due to main propellant tank overpressurization which occurred when the orfice controlled pressurization system blew-down into the full tanks.

Project "Sure-Fire" was initiated, under direction of the Gemini-Agena Target Vehicle Directorate, to modify the XLR81-BA-13 engine to an oxidizer lead at start-up, and demonstrate the flight worthiness of the engine.

3. 8250 Secondary Propulsion System - Test programs were completed on the nitrogen regulator with satisfactory results.

The Unit I thrust chambers operated satisfactorily for 18 seconds during the Gemini Agena Target Vehicle 5002 flight in October 1965.

4. Gas Ingestion Test Program on the YLR81-BA-11 Rocket Engine - A test program was initiated during November and December of 1965 to ascertain the effects of reorientation gas ingestion on the YLR81-BA-11 Rocket Engine. Studies by LMSC have revealed that reorientation gas ingestion occurs when the engine is restarted after propellants have had a chance to decrient in the main propellant tanks. No results from the program were available at the end of the year; however, the program is expected to be complete in the first half of 1966.

5. Propellant Feed, Load and Pressurization System - The development portion of the program to establish a 15 day on-pad-wet capability for the propellant fill coupling was completed. The corrective action was to teflon coat the poppet shaft to eliminate the voltaic action between the dissimilar metals. The requalification of the valves was initiated during this period.

6. Sensor Bar Pinpuller - Qualification of the redesigned sensor bar pinpuller was completed and the new design will be incorporated beginning with Standard Agena Vehicle 143.

7. Model 8133 Rocket Engine - In November this year a development plan was submitted to Hq USAF covering a program that would develop a multi-start version of the YLR81-BA-11, utilizing Nitrogen Tetroxide and a 50-50 blend of unsymmetrical Dimethylhydrazine and hydrazine as propellants. To date the development program has not been initiated.

AEROSPACE GROUND EQUIPMENT DIVISION
HISTORICAL DATA

1 Jul 1965 - 31 Dec 1965

1. (U) The ETR Launch Capability Contract AF 04(695)-688, originally negotiated for $4,761,500 CPIF on the basis of non-concurrent major testing, had to be supplemented to permit concurrent testing during June, July and August and to provide a limited second shift capability. This increased effort was negotiated for $369,150. A second supplemental agreement was negotiated to continue the second shift capability throughout the remainder of the year at a price of $112,399. The ultimate target price of the contract was $5,243,049, as opposed to the original contractor proposal of $6,833,042 to provide concurrent testing capability throughout the year. It is estimated now that the actual cost of the contracted effort closed out 31 December 1965 at $5,318,000. A $65,000 overrun on the negotiated target price, but an approximate $1,500,000 saving when compared to the contractor's proposal.

2. (U) The Follow-On ETR Launch Capability Contract was negotiated December 1965 for $8,800,000. The Follow-On Contract includes concurrent capability, with thirteen launches from three pads over a fifteen month period. In 1965 there were four launches from three launch complexes over a twelve-month period. If all programmed launches actually launch, the cost per launch will be $675,000 as opposed to 1965 cost per launch of $1,300,000.

3. (U) The WTR Launch Capability Contract is tracking an underrun, the potential amount of which is $2,000,000.

[redacted] separately for direct functions associated with launch operations but with the supporting functions still being provided by the Consolidated Launch Capability Contract.

5. (U) The AGE Division has been designated chairman of the Pad Modification Integration Working Group. The responsibilities of this group are to integrate the planning and scheduling activities and to resolve problem areas associated with pad modification work being done on launch complex 75-1, Pads 1 and 2 and Complex 75-3, Pads 4 and 5. This work is mainly in support of the Special Program Offices, but the NASA (LeRC) modification

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effort on 75-1, Pad 1 is integrated into the total activity. A facility work group has been formed at Vandenberg AFB and chaired by the 6595 ATW to monitor and supervise facilities work associated with this complex conversion activity. An activation plan has been prepared and the integrated milestone schedules are reviewed and updated monthly at the working group meetings.

6. (U) An AGE/Test and Launch Operations Management Symposium was established between SSVA and LMSC for the purpose of providing an environment for management decision process (definition and execution), identifying a focal point from which to direct AGE resources towards worthwhile efforts, establishing a forum for discussion of requirements for AGE/test and launch operations improvement areas, improving communication channels, decreasing response time, and establishing a concentrated workshop to reduce travel expenses. The broad objectives defined for this management group are as follows: (a) to strive for better management control of AGE activities, (b) to strive for continued improvement of launch services, (c) continue to search out and implement improved test philosophy, (d) explore new approaches for providing major improvement of performance and/or countdown incentives, and (e) elevate the AGE subsystems within the total Agena system.

7. (U) The General Accounting Office (GAO) conducted an audit of the utilization of System Test Complex C-10. A chronological sequence of events and corresponding correspondence was provided the GAO by the Agena Directorate. Other organizations involved in the utilization of this System Test Complex and in turn requested to provide the GAO with complimentary information were the Gemini Target Vehicle Directorate (SSVT) and the Secretary of the Air Force Special Programs (SAFSP).

8. (U) Because of many complaints by Agena users that Agena AGE was costing too much and many instances of late and/or inaccurate AGE engineering, an agreement was reached between SSD, NASA and the AFPRO to review the LMSC AGE operation in detail. An ad hoc team performed the review at both VAFB and LMSC Sunnyvale during the period 6-16 December 1965. A number of recommendations were developed, for both LMSC and AF/NASA action, which should lead to a more responsive, less costly system.

9. (U) An agreement has been entered into with the START Program to provide them with Agena Directorate support during the conversion of PALC-1, Stand 2 to the START configuration. This assistance will consist of technical reviews of all Agena associated equipment modifications including support of contract negotiations with LMSC. Agena equipment being made available to START includes the umbilical retract mechanism, vehicle air conditioning system, and Agena telemetry ground station. LMSC manpower support will be provided, as required, under the WTR Launch Capability Contract.

[redacted]

11. ~~(S)~~ Technical and activation management assistance has been provided to Program 461 during the conversion of PALC-1, Stand 2 to that program's use. This conversion will be completed during April 1966.

12. (U) Continuing concern over the high cost of modifying and maintaining the present Agena transporters prompted us to investigate an alternate means of safely transporting the Agena vehicles between Sunnyvale and the launch bases. Investigation of currently available special commercial vans resulted in finding one that could probably do the job. We instrumented this van and ran dynamic, vibration and shock tests. The results of the test were sufficiently favorable to warrant a continued investigation of these commercial vans. In April of 1965, Three Way Van Line, a subsidiary of United Van Lines developed a new version of the previously tested van. This new van had a better shock isolation system and promised to be superior to the previous van. The van was tested and the results proved conclusively that commercial equipment was now available for transporting the Agena. Furthermore, subsequent tests on existing LMSC vehicle transporters, with identical instrumentation, showed that these new commercial vans are as good as LMSC transporters.

13. (U) A microwave system will be installed at Vandenberg AFB to support all programs using the Agena vehicle. The system will be capable of providing real time telemetry from any launch complex (supporting Agena vehicles) to the LMSC VADE Computer/Analog Ground Station (AGS) located at Building 8310; also from the Vandenberg Tracking Station to the AGS. The system provides three distinct advantages over the present open loop method:

a. Simultaneous testing on two or more Agena vehicles without frequency interference problems.

b. The possibility of ground testing interference with vehicles on orbit will also be eliminated.

c. The telemetry data at the ground station will be of better quality than the present AGE configuration can provide.

The Agena Directorate has the responsibility for identifying this requirement to all using programs and of coordinating the necessary interface design work and installation to support the microwave system.

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Procurement & Production Division
Historical Data
1 July 1965 to 31 December 1965

1. During the period the Procurement and Production Division (SSVAK) supported the Agena Directorate by issuance of 8 new contracts, definitization of 1 letter contract and administration of 49 active contracts. Total estimated value of these contracts is approximately $340,260,000.

2. During the period it was determined to further breakout Subsystems from the basic Agena procurement and place requirements for horizon sensors and velocity meters with Barnes Engineering and Bell Aerosystems respectively. These procurements will be effected on the next procurement.

3. Upon the completion of negotiation of the AF 04(695)-766 contract with Bell Aerosystems for the direct procurement of 57 Agena engines a cost savings of $1,421,954 was realized. A cost savings was submitted to the SSD Comptroller, but has not yet been verified.

4. Letter Contract AF 04(695)-722 with LMSC was definitized during the period for $32,230,000, but was not distributed prior to the end of the reporting period. The contract was for 57 Agena vehicles less engines.

5. During the period Contracts AF 04(695)-129 and AF 04(695)-545 both Gemini contracts, were transferred to the Gemini Target Vehicle Directorate.

6. During the period contract AF 04(695)-936 for launch services at ETR was settled on a fixed price incentive basis. This is the first fixed price launch contract issued by SSD.

7. During the period 9 orders were made against BOA AF 04(695)-589. They are here listed:

1. Prep Round V
2. Type XIV Battery
3. Type IX Converter
5. Sequence Timer
7. Prep Round VI
8. ZipCord
9. Logistics Support
10. Gas Injection
13. Thorad

Total estimated amount of the above orders $2,600,000.

8. During the period a spares rotation system was established whereby spares are rotated as GFE to the current production contract. This system precludes unneccessary ageing and retrofit of spares and thereby reduces costs.

9. During the period proposal for additional 3 vehicles on the Burner II Program was requested from Boeing Aircraft. Negotiations are scheduled for February 1966 the additional vehicles will be added to contract AF 04(695)-754 by supplemental agreement.

10. During the period RFPs were issued to Bell and LMSC for follow Agena production. These two RFPs will result in letter contracts AF 04(695)-938 and AF 04(695)-939 with Bell Aerosystems and Lockheed Space Systems respectively.

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Requirements and Programming Division
Historical Report
1 July 1965 - 31 December 1965

1. (C) Agena Flight Summary

On 30 September 1965, SSVA distributed the Agena Flight Summary Report to program and staff offices within SSD, Hq AFSC and Hq USAF. This report described and assessed all Agena flights through 30 June 1965. During the period 1 July 1965 to 31 December 1965, 17 Agena vehicles were flown making a total of 186 flights. Of these 17 flights, 16 were of the current Agena D configuration. The remaining flight was the NASA ISIS X Agena B vehicle. The overall Ascent Success ratio of the Agena D now stands at 92.3%.

2. (U) Production Reliability Evaluation Program

During this period the Production Reliability Evaluation Program (PREP) testing of Agena components continued. The fifth series of tests (Round V) was completed during December. Round VI was started in September and by 31 December was about 50% completed. Planning for Round VII was initiated in November and proceeded satisfactorily toward a scheduled start date of 1 April 1966.

3. (U) Agena Component Screening

As a result of the Agena Spares Screening Program, which eliminated questionable spare hardware from flight status, a continuing screening program is being implemented. This program will impose tighter accept/reject criteria on the technical evaluation of flightworthiness of all Agena components and will provide greater assurance of vehicle quality and reliability to using programs.

4. (U) On 19 November 1965, SSVA received DDR&E approval for a follow-on buy of 36 vehicles as follows:

-939 Contract delivery schedule:

1967											1968			
F	M	A	M	J	J	A	S	O	N	D	J	F	M	A
3	2	3	2	3	2	3	2	3	2	3	2	3	2	1

5. (U) LMSC Operating Schedule

LMSC Official Operating Schedule, Issue #28, was distributed to the Program Offices on 2 December 1965. The Lockheed Schedule depicts the milestones, systems test and launch stand loading for all programs using the Agena vehicle. SSVAR acts as the SSD central point of contact for LMSC in coordinating and obtaining approval for the information presented in this document.

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DOD DIR 5200.10

6. (U) Work Statements

During this time period the following work statements were prepared and submitted to SSVAK for contractual implementation:

a. Type X DC/DC Converter

b. Sequence Timer Redesign

c. PREP Round VI (Vehicles 121 through 144)

d. MOD IIA Velocity Meter

e. Zip Cord Study

f. Parts Repair and Logistics Services

g. Gas Ingestion Testing

h. THORAD Support

i. PREP Round VII (Vehicles 145 through 166)

j. -939 Contract (Agena Production)

k. -938 Contract (Engine Production).

7. (U) THORAD/Agena Bungee Test Support and Compatibility Study

In December 1965, at the direction of SSVA, LMSC Standard Agena began preparations for support of the THORAD/Agena Bungee Test Program which is to be conducted by the Douglas Aircraft Company at Santa Monica in April 1966. The THORAD, designed and produced by the Douglas Aircraft Company, is essentially a Thrust Augmented THOR with additional propellant capacity and greater payload capability. One of the Air Force Using Programs will begin THORAD launches in 1966. LMSC support of the Bungee Test consists mainly in supplying a development test vehicle (DTV 0102) for the test and providing Agena D technical data to DAC. The Bungee Test consists of suspending the THORAD/Agena DTV Vehicle by elastic connections (2 points) in a horizontal position. The vehicle will be vibrated to verify: (1) the structural simulations used in computing theoretical body bending modes, and (2) the rate gyros mounting structure. LMSC was also directed to prepare, for submittal to SSVA in January 1966, a list of those tasks necessary to define THORAD/Agena interface parameters and insure THORAD/Agena compatibility.

8. (U) Increase in Agena Structural Capability

In December 1965 LMSC was directed to prepare an ECP to provide for increased skin thickness on the Agena aft tank skirt and the booster adapter. This direction was prompted by one of the using program's requirements for increased structural capability for dog-leg missions. This beef-up will provide approximately 30% greater structural capability at a net payload penalty of approximately 7 to 9 pounds. The effectivity of the ECP is planned for Vehicle AD-166.

9. (U) Agena Long-Range Improvement Program (Phase II)

The LMSC Agena Long-Range Improvement Program (Phase II) Proposal was received in SSVA in February 1965. The objective of the proposal was to increase the orbital reliability of the Agena vehicle through hardware changes. SSVA's final evaluation of the proposal was submitted to LMSC in October 1965. Of the approximately 20 changes proposed, SSVA has indicated a definite interest in the following:

a. New Main Electrical Umbilical and Increased Vehicle Checkout Capability.

b. P-700 and P-701 Pullaway Connector Changes

c. Vehicle Electrical Connector Improvement

d. MD 380 Wiring

e. Propellant Vent Coupling Redesign

f. Guidance and Control Electronic.

Items a and f are being covered under a BOA -589 Order, while the remaining items are still in -695 Program Plan Status.

10. (U) This report is classified CONFIDENTIAL because of Paragraph 1, which reveals Agena flight success ratio.

[redacted]

[redacted]

3. The items to be procured under the attached Class Findings constitute special and technical property by reason of the complexity of the items, the substantial initial investment and the extended period of preparation for manufacture. These items, if procured by the advertising and competitive bidding procedure, would require duplication of Government investment and duplication of lengthy preparatory effort.

4. The major sub-system procurements to be negotiated pursuant to the attached Determinations and Findings have an estimated monetary value of $32,500,000. The following is an analysis of each sub-system supplier, the Air Force investment, an analysis of what would be required to duplicate the Air Force investment, and the delay that would be encountered if another source were chosen.

a. Investment for equipment (Lockheed Missiles & Space Company):

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6-26-66

[redacted]

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[redacted]

Investment for Equipment. (Bell Aerosystems Company)

(1) Both the Government and the contractor have made a substantial initial investment in the capability of the Bell Aerosystems Company (BAC) to produce the engines and velocity meters. This initial investment is a part of the basis which precludes advertisement of this requirement on the open market.

(2) The Government has made a substantial investment toward acquiring the capability to create the S-01 Primary Propulsion Engine and Velocity Meter, both in the form of subcontracts for research and development, and in tooling and test equipment. To date, the Government has provided Bell Aerosystems Company approximately $5.2M of industrial facilities, therefore, it would not be feasible to transfer the facilities to some other company. In addition, the Government has an investment of approximately $1.5M in tooling, special test equipment and checkout equipment which likewise could not be transferred to any other contractor.

(3) The amounts indicated above were determined by reference to industrial facilities contracts and estimates of special tooling and test equipment from various subcontracts related to the Air Force satellite programs with LMSC. The contractor's contribution was obtained from the contractor on an informal basis.

c. Investment for Equipment (Barnes Engineering Company)

(1) Both the Government and the Contractor have made a substantial initial investment in the capability of the Barnes Engineering Company of Stamford, Connecticut, to produce the Horizon Sensor Components. This initial investment is a part of the basis which precludes advertisement of this requirement on the open market. To date, the Government has provided Barnes approximately $225,000 for test equipment, special tooling and check-out complexes which could not readily be transferred to any other contractor. The contractor's investment in the Stamford operation is approximately $1,500,000.

(2) The amount indicated above was determined by estimates of special tooling and test equipment furnished through subcontracts with LMSC. The contractor's contribution was obtained from the contractor on an informal basis.

d. Duplication of an extended period of preparation.

(1) The major categories of work required to prepare for production by a contractor other than Lockheed Missiles and Space Company, Bell Aerosystems Company and Barnes Engineering Company would include the creation of considerable production facilities of exceptionally complex equipment for the reliability required. It would include design and fabrication of tooling according to the production methods of any company which might be selected; it would include the recruitment and training of production engineers, technicians, manufacturing personnel, quality control personnel, etc. Additionally, this would include the requirement for suitable types of management.

(2) Assuming that an otherwise qualified producer could be found, and that he could devise production methods and obtain production equipment, as well as tooling, it would be necessary that a prototype be fabricated and tested prior to commencement of production. Experience has shown that components, when combined as a system, may function perfectly under ground test conditions, but fail in flight under environmental conditions found in space. Hence, it would be required that one or more prototypes be flown with extensive telemetry instrumentation to diagnose the effectiveness of the system and to identify the cause of failures. In short, the cost of obtaining confidence in a new supplier's product would amount to a development program.

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2. Procurement Background

(1) The Lockheed Missiles and Space Company developed the S-01 vehicles under several contracts, the first of which was awarded in October 1956. Several versions of this vehicle were produced under the Agena A and Agena B nomenclature. The Agena C version was not procured. The first contract for research, design development, and qualification of a Standard S-01A configuration (Agena D) was awarded in August 1961. This contract also provided for the production of 12 units, design and qualification of optional equipment, and initiation of a component improvement program. To date, all of these units of the S01 have been delivered and accepted by the Air Force. An additional 114 units were delivered in CY-1962, CY-1963, CY-1964 and CY-1965. Follow-on production contracts for the Agena have been awarded for 93 units with deliveries continuing through April 1968. The first S-01 contract provided for tooling and a capability to produce at the rate of five (5) units per month in anticipation of the contracts contemplated by this request. Technical data which will ultimately serve as the basis for developing a procurement package is operationally accumulated concurrently and continually. The rapid improvement in the state-of-the-art requires day-to-day program adjustments. This instability in technology eliminates all possibility for scheduling the creation of procurement data suitable for competitive solicitation. Freezing the design of the S-01 for the sole purpose of establishing a competitive approach in procurement would be against the national interest.

(2) The Bell Aerosystems Company developed the S-01 Primary Propulsion Engine and Digital Velocity Meter under several subcontracts with Lockheed Missiles and Space Company, the first of which was awarded in the last quarter of CY 1956. In general, the quantities, the pace set, and justification coincide with the remarks covering the S-01 above. Decision was made in CY 1964 to furnish the engine seperately to Lockheed as GFE. The first engine contract was let with Bell in CY 1965, and a follow-on contract was awarded in CY 1966. Decision was reached in CY 1965 to furnish the velocity meter seperately to Lockheed as GFE. The first direct contract was let in CY 1966. Contracts contemplated are follow-on in nature.

(3) The Barnes Engineering Company developed and produced the Horizon Sensor used in the Standard Agena under several subcontracts with Lockheed Missiles and Space Company. Production has been continuous since CY 1960. Decision was made in CY 1965 to furnish the horizon sensor seperately to Lockheed as GFE. The first direct contract was let in CY 1966. Contracts contemplated are follow-on in nature.

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS SPACE SYSTEMS DIVISION (AFSC)
AF UNIT POST OFFICE, LOS ANGELES, CALIFORNIA 90045

REPLY TO ATTN OF: SSVA

29 JUL 1966

SUBJECT: Historical Report for the Period of 1 January 1966 - 30 June 1966

TO: SSEH

One copy of the SSVA Historical Report and each Divisional Report is submitted as requested.

CECIL E. RIDDLE, LtColonel, USAF
Deputy Director, Agena Program
Deputy for Launch Vehicles

10 Atchments
1. Organizational Chart (2) copies
2. SSVA Report (C)
3. SSVAE-1 Report
4. SSVAE-2 Report (C)
5. SSVAE-3 Report (C)
6. SSVAE-4 Report
7. SSVAC Report
8. SSVAO Report (C)
9. SSVAK Report
10. SSVAP Report

Copy to: SSVA

If inclosures are withdrawn (or not attached) the classification of this correspondence will be unclassified

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DOD DIR 5200.10

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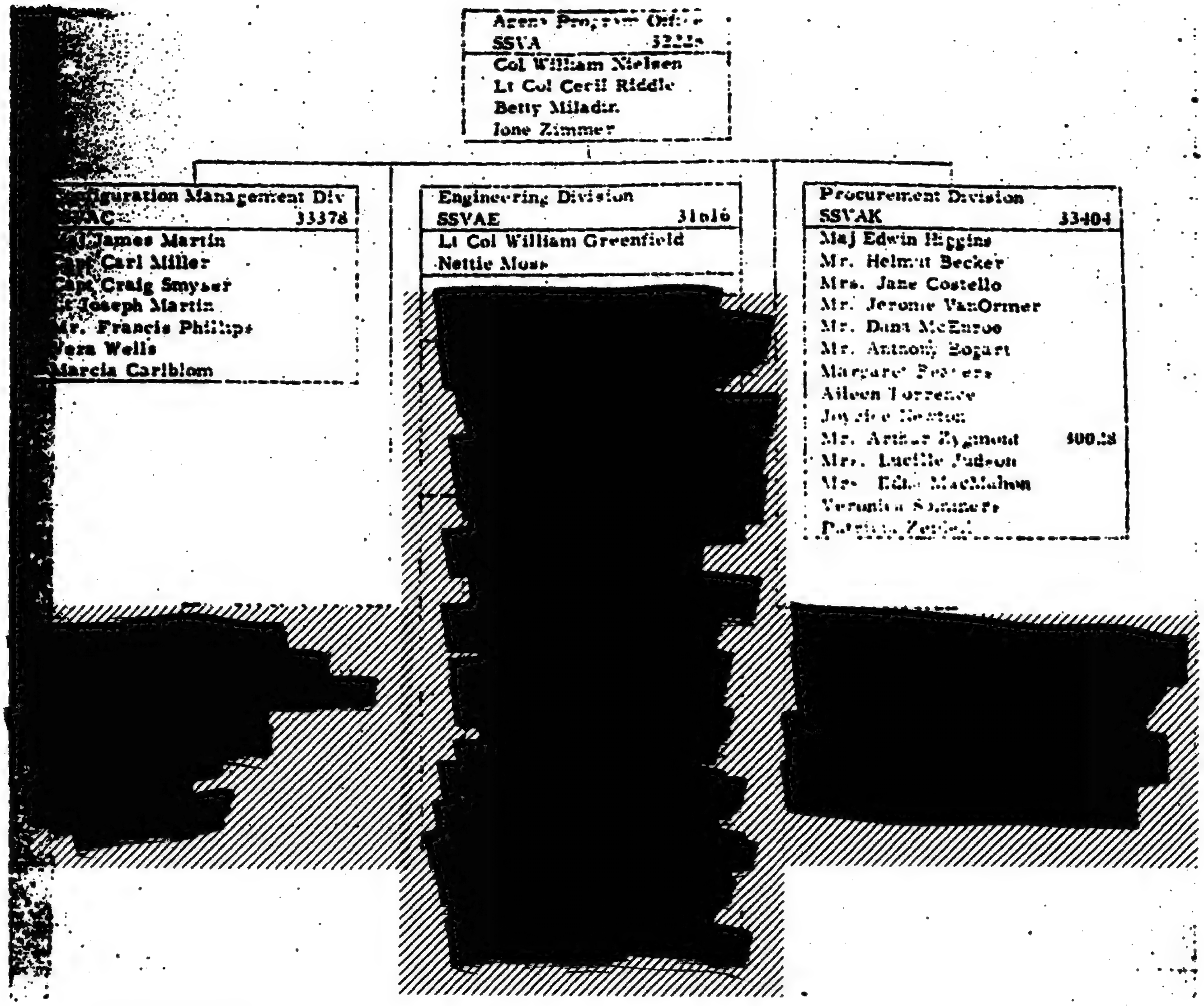

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[redacted]

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DEPARTMENT OF THE AIR FORCE
[illegible]
[illegible]

REPLY TO
ATTN OF: SSVA

SUBJECT: Historical Report, 1 January 1966 - 30 June 1966

TO: SSEH

1. (U) The Agena Directorate is responsible for the management and technical direction of contractors' efforts for the definition, design, production, modification, storage, logistic support, test and launch support of the Agena space vehicle for all using programs. This includes certain engineering and procurement support to specific programs. The Directorate provides Aerospace Ground Equipment engineering support and facilities activation for all using programs and is responsible for managing and directing the Agena launch services contracts for the Eastern and Western Test Ranges. The Burner II Space Vehicle responsibilities were broken out from the Agena Directorate, and the Burner II division became a directorate on 15 June 1966. On this same date, the Agena Directorate was reorganized. The Aerospace Ground Equipment Division became the Operations Division and the Requirements and Programming Division became the Program Control Division. The Configuration Management Division, the Procurement Division, and the Engineering Division remained unchanged, although there was some transfer of personnel between divisions and an internal reorganization in the Engineering Division. Colonel William C. Nielsen is the Agena Program Director and Lt Colonel Cecil E. Riddle is the Deputy Director. (See attached organizational chart.)

2. ~~(C)~~ During the period of 1 January 1966 to 30 June 1966, twenty (20) Agena Vehicles were flown, making a total of 206 flights. Of these 20 flights, 18 were of the current Agena D Configuration. The other two were last of the Agena B Configuration. The overall ascent success ratio of Agena D Space Vehicles now stands at 91.7%.

3. (U) During this period, twelve new contracts were issued and two letter contracts were definitized. Including 22 active contracts, the total estimated contracts value is 535 million dollars. On the date that the Burner II Division became a separate Directorate, contract AF 04(695)-754 and related records were transferred to that Directorate. Four orders were made against the BOA contract. Virtually all new contracts are fixed price or fixed price incentive rather than cost reimbursable.

4. (U) The Configuration Management Engineering Change Proposal (ECP) workload was heavier than normal during this period (76 ECPs). Consequently, new procedures were initiated to more effectively process ECPs and to facilitate imputs to the Configuration Control Board Meetings.

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One such procedure used was to have the contractor send ECPs direct to the National Aeronautics and Space Administration (NASA), Eastern Test Range, and Western Test Range. The Configuration Management Division also evaluated numerous program plans and work statements.

5. (U) When the Aerospace Ground Equipment Division was designated the Operations Division, it was given responsibility for the Agena interface with the using programs, for contract AF 04(695)-761, the Santa Cruz Test Base Sustaining Contract, and the Radio Guidance Functions with the contracts associated with this effort.

6. (U) Discussions continued with SAC and ADC concerning turnover and utilization of Ground Guidance Station (GGS) No. 6. SAC will vacate this station early in FY 67. The present plan is to move from GGS No. 4 and consolidate SSD operations in GGS No. 6-1 and No. 6-2 late in FY 67. ADC will then occupy GGS No. 4. Firm approval of the plan is expected from ADC during July 1966.

7. (U) Our program to qualify special "Air Ride" vans for Agena road shipments is complete. Special "Air Ride" vans provide shock and vibration protection required by the Agena; in addition, an increased margin of environmental protection is provided.

8. ~~(C)~~ Technical and activation management assistance was provided to Program 206-II during the activation period of the conversion of PALC 2, Stand 3 from an Atlas/Agena configuration to a Titan IIIB/Agena configuration. Technical and activation management assistance was provided to Program 461 during the conversion of PALC 1, Stand 2 to their use.

9. (U) In accordance with the direction given LMSC by SSVA letter, subject: Standard Agena Slave Plan, dated 29 June 1966, and CCN 108, MSC-3252, dated 24 June 1966, Standard Agena item of hardware, currently not being used by using programs, will be slaved during the Standard Agena system test cycle. It is currently planned to continue this slave system (except those items of hardware to be replaced by the new Guidance Control Electronics (GCE) Configuration at AD-205), through the -939 contract. This total effort will be accomplished without the benefit of changing engineering drawings, and will be scheduled and controlled by the Standard Agena Program Office in accordance with Implementation Plan. The hardware to be used for slave units will be furnished LMSC as government furnished property (GFP) and painted red for ready identification and will be identified with the contract end item, component part number and unit serial numbers. The estimated savings that will be realized by this slaving, starting with Vehicle effectivity AD-160 and subsequent, will be $1,500,000 through the -939 Contract.

10. (U) On 9 June 1966, the Agena Directorate, in conjunction with the AFPRO and LMSC, conducted the first in a planned series of Agena vehicle

HISTORICAL REPORT
1 January 1966 — 30 June 1966
Subsystems C and D
[illegible]-1

I Personnel and Organization

The Communications and Electrical Power Section became the Electronics Branch with the reorganization of the Agena Program Office. This change did not affect function or manning. The branch is authorized five Engineering Officers (2825A and 2825B) and one Clerk-Typist. The branch was short one Engineering Officer at the beginning of the reporting period. Since then an additional officer has been transferred to the MOL Office. The Clerk-Typist position was also vacant at the end of the reporting period.

II Main Electrical Umbilical (MEU)

A redesign of the Main Electrical Umbilical (MEU) for the Standard Agena has been underway during this reporting period. The idea of a new MEU originated in early 1965 with the LMSC proposal for a Phase II Agena. LMSC stated that the present MEU had several deficiencies, mostly involved with Ground Handling: Susceptibility to damage, difficulty of repair, difficulty of properly mating, poor back-up release system, lack of positive clocking, etc. Continuing discussions and chart presentations by LMSC lead to an Air Force decision last December to proceed, but to initiate a Basic Ordering Agreement item rather than to use LMSC's program plan. The work formally began in March 1966.

As of May, LMSC still had not submitted a technical proposal for the work to be done. Our past experience with LMSC has shown that a lack of definition of the goals and how to go about achieving them will invariably result in wasted funds and lost time. Experiences such as the Type XIV Battery, have taught us that we must institute controls very early in Development Programs if we are to properly manage the contractor. Therefore a hold was placed on any further MEU work on 11 May 66 until technical and cost proposals were received and evaluated. We asked that the proposals include: A definition of the tasks needed to be done through final incorporation into the Agena, estimated cost per task, definition of tasks to be subcontracted, identification of other contracts that would be affected and estimated cost to those contracts, per-unit Delta cost after incorporation, and estimated total cost to the government.

A technical proposal and partial cost estimate were received late in May 1966. The cost estimate covered only changes to the Standard Agena Vehicle; the ROM had risen to $613,000 from a previous estimate or $474,000. The cost to modify AGE and the cost to Using Programs will be much greater than the Standard Agena vehicle costs. An estimate for these additional costs was received on 29 Jun 66 and is now being evaluated. This effort has been slowed down by LMSC's reluctance to comply with our requests, even though what we have asked for constitutes nothing more than basic management tools. LMSC has shown a desire to deal very informally and only verbally. It is such methods that have prevented the desired level of Air Force control in the past.

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III Type IIA DC/DC Converter

The development of the Type IIA DC/DC Converter, used in the Guidance System, was successfully completed during this reporting period. Qualification testing began in January and was completed 16 March. Vehicle compatibility testing was performed in March. An extended life test will continue until next year. The only significant problem in the testing was out-of-specification conducted interference during EMI testing. LMSC requested that the converter specification be loosened to permit the out-of-specification condition. The change was permitted only after LMSC agreed to take a second look at all data and guarantee that the condition would not affect vehicle performance.

Delivery of the first production units were plagued by problems in procuring electrical piece parts. The first two units were delayed by a shortage of two types of Motorola transistors. Production of Unit #7 was slowed by the delivery of Westinghouse diodes. Motorola transistors were the pacing item for Unit #9. Unit #15 was delivered two weeks late by a production problem with Continental Devices transistors.

IV Destruct Discrete J-Box Redesign

An effort to redesign the Destruct Discrete Junction Box (D/D Box) has been initiated. There are presently two versions of the D/D Box — one for the normal booster adapter and the other for the maximum access booster adapter. Redesign will cut costs by creating a single standard box. The work statement was jointly written by SSVAE-1 and LMSC in February; this co-authorship shortened the initial effort by about five weeks by cutting coordination time. It was later decided to add a reliability demonstration requirement. Therefore the redesign will be by fixed price contract rather than a BOA item. The RFP was submitted to LMSC 29 Jun 66. The issuing of the RFP was delayed by LMSC's reluctance to accept parts-materials-process controls and by the redirection from BOA item to a separate contract.

V Ampere Hour Meter Redesign

LMSC has proposed a new Ampere Hour Meter (AHM) that would be more accurate than the present AHM. In March SSVAE requested additional data to permit an assessment of the effect of the increased AHM accuracy on system accuracy. System accuracy depends on the individual accuracies on 3 items: battery capacity, power needed by typical mission profile, and amount of power already used (determine by the AHM). Knowledge of these 3 items permits an estimate of remaining battery life (which relates to remaining mission life). The additional data has not yet been received.

VI Electrical Piece Parts

Approximately 31 Type IX DC/DC Converters were scraped because of a defective capacitor. The capacitors (GE Types 29F30XX and 29F34XX) lacked a true hermetic seal and were subject to internal shorting.

VII Engineering Change Proposals

The Electronics Branch has been deluged with a large number of Engineering Change Proposals (ECP). Most of the ECPs were difficult to evaluate due to incomplete cost data and lack of supporting technical data. Continuing discussions with LMSC through SSVAC have resulted in some improvement in cost data.

VIII Command Destruct System

A rather serious problem arose last March when the Range Safety Office at ETR disapproved the Standard Agena Command Destruct System, even though the same system has flown in the past. The disapproval came after ETR conducted a new review of the system, and it is based on the interrelationship of the battery, receiver, and destruct unit. The destruct unit (a 1 ohm device) draws a very large current when activated. The surge current causes the battery terminal voltage to drop to 9 volts. The receiver, designed to operate with at least 22 volts, can't continue to operate at 9 volts. After 10-20 milliseconds, the receiver outputs relays deactivate, removing power from the destruct unit. Tests and calculations by LMSC indicate that the destruct unit will always detonate before the relays dropout. But ETR won't accept statistical detonator sure-fire times; they insist that the destruct relays remain activated unless the command is removed.

ETR is reluctant to define minimum system requirements. LMSC is reluctant to work aggressively on the problem since they do not admit there is a problem. This has slowed resolution of the problem.

As of 30 June, a program plan for a minimum system redesign has been prepared by LMSC at AFSSD direction. The plan is now being evaluated by AFSSD.

IX Type XIV Zinc Oxygen Battery

The first three months of 1966 were spent investigating and identifying plating bath parameters which required positive control to ensure quality and repeatibility of producing acceptable zinc anodes. Those parameters which had the greatest affect on the quality of zinc plated were found to be the zinc ion concentration, pH of the solution, and current density. At Air Force direction, quality control and plating specialists were sent to the subcontractor facilities (Eagle-Picher). This team investigated the plating procedures and equipment of Eagle Picher and provided recommendations for corrective action. Arising from this investigation was a recommendation that larger plating tanks be purchased along with temperature controllers and circulating pumps to assist in providing better control over the plating solution. This recommendation was accepted by Eagle-Picher. Plating parameters were optimized for the new equipment and rigid quality control procedures were established. Fabrication of zinc anodes using the new equipment began in mid-March and was completed during the first week of April. The pilot cells representing this batch of anodes discharged to capacities which were well within allowable limits of the specification. On the basis of the success of the pilot cells and a careful review of the quality control procedures go ahead was given for fabrication of cells to be used in the matrix test. Cell activation began on 22 April and the beginning of the matrix testing followed shortly after. During the second week of May, initial results of the matrix test indicated that amp-hr capacities were considerably below the minimum specification value of 825 amp-hr. The failures were both time and temperature dependent; they were of a degradation nature in the form of reduced capacity but were not catastrophic. Cells tested at 30°F did better than expected (at least one cell reached a capacity of over 1000 amp-hr) those at 100°F did poorly. The final design review was held on 8 June. At this meeting all significant events of subcontractor effort were reviewed. A failure mode analysis conducted by the contractor was not completed at the time of the final design review and therefore no definite statement concerning the mode of cell failure can be made until this report is received. However, observations from preliminary cell dissection indicates that there was an incomplete utilization of zinc on the cell anodes.

X Type 1H Primary Battery

The final design review for the Type 1H Battery was held on 5 April. The battery passed the environmental test with no anomalies. Eagle-Picher issued the qualification test report; a qualification certificate was issued by LMSC. The additional 1H battery cell testing which was in process during the design of the 1H battery is now complete; the final report will be submitted by the contractor shortly.

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HISTORICAL REPORT - SYSTEMS ENGINEERING BRANCH (SSVAE-2)

1. (U) Systems Engineering Branch Organization
2. (U) Engineering Management
3. (U) Agena Flight Summary - Part Item (C)
4. (U) Reliability Demonstration Requirements
5. (U) Agena Vehicle Audit
6. (U) Production Reliability Evaluation Program
7. (U) Work Statements

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1. (U) Systems Engineering Branch Organization

The Systems Engineering Branch was formed on 1 April 1966 as a part of the Agena Directorate reorganization. In addition to the system engineering function, the responsibilities of the Branch include engineering management, reliability, maintainability, quality assurance, vehicle interfaces, and preparation of work statements.

2. (U) Engineering Management

As mentioned in the previous report, the intended function of the recently activated Engineering Management Office (EMO) is simply this: To shorten (and to unclog) the communications channels between the sources of management information and the decision-makers (both managerial and technical) who need that information.

At the closing date of this report some small inroads had been made into the tangled communications "jungle" which had, over the years, overgrown paths of communication laid out in earlier periods. Three (of the many readily apparent) problem areas which were engaged during this period included the problems of works simplication, time dissipation, and information disseminations.

Attachment A is an example of a typical multiple-user, minimum-effort form developed and put into general usage during the period in order to reduce and simplify administrative workload in connection with processing developmental engineering "Program Plans".

Attachment B was developed for several reasons; among these were (1) to "screen out" unwanted (and time-dissipating) agenda items which had begun to make covert appearances during technical direction meetings, and (2) to give the chief of the engineering division an advance opportunity to not only acquaint himself with the background information on decision requirements he would shortly be confronted with, but also assure that appropriate technical people would be on hand during contractor "pitches."

Attachment C and D are typical of the information-dissemination forms put into use during the period.

Other major areas of managerial concern which were being dealt with by the EMO as this period closed included cost controls over budgeted contractor developmental engineering efforts; tighter administration over the innumerable "suspense" communications processed by this division; and the reduction of our engineers' efforts through both elimination of duplicate efforts and through better documentation of "solved" (but recurrent) problems. Much progress in coping with all of these areas still lies ahead, unfortunately,

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rather than behind as the period closed.

Finally, during this period one "battle" was fought (and lost) by the Standard Agena Office in behalf of the EMO. Despite the increasingly obvious need to man the EMO function -- both now and in the future -- with an incumbent trained in managerial disciplines, our attempt to recast the EMO's "square peg" card description to reflect less pure engineering and more managerial training where totally unsuccessful. As a result, the EMO function goes on under the UMD disguise of an electronic engineering "slot", and will, in all probability, disappear without a ripple when the present incumbent is reassigned.

3. (U) Agena Flight Summary (Following item is Confidential)

~~(C)~~ On 30 March 1966, SSVA distributed the Agena Flight Summary Report to program and staff offices within SSD, Hq AFSC and Hq USAF. This report summarized the results of all Agena Flights through 31 Dec 65. During the period 1 January 1966 to 30 June 1966, twenty Agena vehicles were flown making a total of 206 flights. Of these 20 flights, 18 were of the current Agena D Configuration. The other two were the last of the Agena B Configuration and were the NASA Nimbus and OGO-E flights. The overall ascent success ratio of the Agena D space vehicle now stands at 91.7%.

4. (U) Reliability Demonstration Requirements.

On 8 June, the Agena Directorate successfully negotiated a contract with Bell Aerosystems Co. which contained a requirement for statistical demonstration of a reliability requirement. This is the first instance in the Agena directorate in which a combined development and production contract, containing a realistic reliability demonstration requirement has been negotiated on a fixed price basis.

5. (U) Agena Vehicle Audit.

On 9 June 1966, the Agena Directorate, inconjunction with the AFPRO and LMSC, conducted the first in a planned series of Agena vehicle audits. The audit consited of a detailed inspection of Agena AD-150 and review of selected vehicle documentation. The purpose of these audits is to insure that vehicles conform to specified requirements and meet acceptable levels of quality and reliability. A number of manufacturing and documentation problems were detected and corrective action is in process.

6. (U) Production Reliability Evaluation Program

During this period the Production Reliability Evaluation Program (PREP) testing of Agena components and selected Program Peculiar components continued. PREP Round VI was started in September 1965 and as of 30 June 1966, it was about 95% completed. Round VII was started in April 1966 and as of 30 June it was about 30% completed. Planning for Round VIII was initiated in February 1966 and proceeded satisfactorily toward a scheduled start date of 1 September 1966.

7. (U) **Work Statements**

During this time period the following work statements were prepared and/or submitted to the Contracts Division (SSVAK) for contractual action:

a. Production Reliability Evaluation Program Round VIII (Vehicles 166 through 186)

b. Agena Technical Assistance Program

c. Electronic Event Timer Phase I

d. Guidance and Control Electronics Design and Production

e. Main Electrical Umbilical Redesign

f. Engineering Support Contract

g. Booster Discrete/Destruct J-Box Improvement

h. Horizon Sensor Direct Procurement

i. Mod X Digital Velocity Meter System Direct Procurement

j. Gas Ingestion Program

k. Thorad Test Support

l. Type IH Battery Cell Testing

m. Agena Brazed Plumbing System

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HISTORICAL REPORT

1 January 66 - 30 June 66
Subsystem D (Guidance) SSVAE-3

DEVELOPMENTS

1.1 New Horizon Sensor Concepts

1.1.1 The Belock Instrument Corporation began their development of a "Solid State Horizon Scanning Technique" under Contract AF 04(695)-924. The objective of the program is to develop and demonstrate a photoconductive detector suitable for use with the Belock Solid State light beam scanner. The development is progressing on schedule and should be completed by January 1967.

(C) 1.1.2 The Quantic Industries development of a "High Accuracy Horizon Sensor System continued during this period under Contract AF 04(695)-918. The objective of this development is to achieve a light weight sensor having an accuracy of better than 0.1° (including horizon variations) with only one moving part. The moving element in the system is a mirror which is deflected by heating thermostatic bimetal elements electrically. These bimetal elements also support the mirror, and so no bearings, sliding surfaces, lubrication, or hermetic seals are needed for operation in a vacuum. A preliminary tracker was fabricated which demonstrated the feasibility of this program. The development is one-month behind schedule but it should be completed by November 1966.

1.2 Guidance and Control Electronics (GCE)

LMSC continued development work on the GCE package under Contract AF 04(695)-695. The GCE consists of a Flight Control Electronics Module, a Switching and Instrumentation Module and a Test Program Module. These three modules will replace the Flight Control Electronics Package, the Flight Control J-Box and Patch Panel, the Guidance J-Box and various Program J-Boxes. All drawings necessary for the fabrication and assembly of the GCE modules were released. LMSC delivered to SSVAE a reliability demonstration plan and began work on a Failure Mode Analysis. The production of the Design Proof Units was started about mid-May. An RFP was issued to LMSC in May for one design proof unit, two preproduction units, and 25 production units. Delivery of first units is scheduled for September 1967.

1.3 Inertial Reference Package

1.3.1 MIT continued the design of a three-axis, strapdown Inertial Reference Package (IRP) for use in the Guidance System of the Agena. In addition they began fabrication of a prototype single axis of the three axis design to demonstrate the performance and reliability of the Selected Gyro and its associated electronics. MIT also conducted a Gyro Industry Survey and selected the Kearfott Alpha Series Gyro for the single-axis configuration since it came closest to meeting the requirements.

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1.3.2 The general packaging approach is cordwood module construction featuring easy removal and replacement of gyros. The three gyro channels will be packaged as identical and interchangeable electrical mechanical modules to simplify testing and failure analysis. A thermostatic piston controller has been designed to maintain the gyro block through an ambient range of 60° to 135°.

1.3.3 The development of the flight configured single axis unit has progressed with a view towards ultimately fabricating a three-axis strapdown IRP for the Agena based upon the experience of the present study. If this materializes the first production units will be available by 4th Quarter of 1967.

1.4 DVM Mod X Velocity Meter System

Bell Aerosystems Co. has been chosen as prime contractor to develop and produce the Bell Digital Velocity Meter (DVM) System Mod X. Negotiations were completed in June; a contract will be issued in July. The Mod X System will be smaller, lighter and more accurate than the present Mod II velocity meter. Work began in June 1966 and delivery of the first production unit is expected in 3rd Quarter 1967.

1.5 Sequence Timer

1.5.1 Solid State Timer Survey. LMSC conducted an Electronic Timer Survey of Industry and issued a feasibility study report. The conclusion reached is that an electronic timer with increased reliability and performance is entirely feasible for the Agena system. Several contractors have the capability to design and produce a timer to meet our requirements using already developed techniques and building blocks. Development of a new timer is expected to begin soon with delivery scheduled for 4th Quarter 1967.

1.5.2 Improved Timer Switch. Efforts to improve the present switch are continuing. The problem is switch contamination of two types; (1) foreign material and (2) migration of silver contact material through the gold plating which forms a silver sulfide contamination. LICON, the switch manufacturer, has received samples of new contacts which use a nickel barrier between the silver contact material and the gold plating. Testing to date is not conclusive, but samples of these new contacts have been shipped to LMSC for further analyses. To control foreign material contamination, LICON proposes to establish a separate high quality assembly line for manufacturing the LMSC switch. Significant improvement can be expected from this action since all switches manufactured to date have been assembled on a commercial type line. LMSC has been instructed to vigorously pursue all switch improvement efforts without delay.

1.6 Mod IIC Horizon Sensor System

A decision was made to procure the Mod IIC Horizon Sensor System (HSS) direct from the vendor rather than procure through LMSC as in the past. The decision was based on the savings which could be realized by eliminating the LMSC subcontracting fee. A contract was negotiated in May 1966 and the first production GFP HSS units will be delivered to LMSC in October 1966.

2. MAJOR PROBLEMS

2.1 U.S. Semcor Capacitor

Investigation of Semcor capacitors used in the Velocity Meter Counter and Flight Control Junction Box indicated a serious material deficiency. The elastomer seal in the capacitor allowed electrolyte leakage around the tantalum anode lead. The resulting chemical reaction with the nickel lead and end-seal metal allowed both internal and external corrosion and high DC leakage paths. The failure mode of the capacitors is excess current leakage which in extreme cases results in a dead short. Corrective action requires the replacement of suspect capacitors. Retrofit and in-line incorporation actions have been initiated.

3. PERSONNEL

3.1 The Guidance and Control Subsystem became the Guidance Branch as a result of the Agena Directorate reorganization. One additional guidance slot 2845D was added for BTL and GE Guidance Support; however, the officer who came with this slot has since departed. In addition, Capt Dempsey was transferred PCS during this period. This leaves the Guidance Branch only 50% manned (3 of the 6 authorized positions are vacant) at a time when a number of new developments and direct procurements which will require close monitoring are scheduled to begin.

Historical Report
1 January 1966 - 30 June 1966
Mechanical Branch
SSVAE-4

Subsystem A

1. Titan III B/Agena

All of the static structural tests of the booster adapter for this vehicle have been completed. These tests showed that the adapter will withstand the predicted flight loads with adequate margins of safety.

Based on acoustic and vibration tests, it was found that the adapter self destruct system components could successfully survive the predicted flight acoustic levels. It was originally thought that shock mounting of these components would be necessary since the acoustic tests indicated that the system would be exposed to vibrations far in excess of the existing qualification levels. Later tests proved that the components would operate satisfactorily under flight conditions. However, to provide additional assurance that the destruct/discrete J-box would function in flight as required, its mounting position was changed. This involved relocating the unit from the adapter skin to the truss structure, which is subjected to a lower level of flight induced vibrations.

At the end of this report period, this booster adapter will be taken over from SP-14 and produced by Standard Agena as an optional kit. The first units are being manufactured by the using program and the first flight of this vehicle is scheduled to take place early during the next report period.

2. Booster Adapter Equipment Vibration Tests

During the last report period, a Thor/Atlas booster adapter was subjected to an acoustic field. The results showed that the destruct system would be exposed, during Titan III B and TAT flights, to vibration levels considerably above those to which the components had been qualified. Action was taken in January 1966 to design shock mounts for each component to provide attenuation of the acoustic induced vibrations. The self destruct battery and discrete/destruct J-box were then vibration tested to determine how much dumping the shock mounts would provide. These tests demonstrated that the vibration levels were reduced but were still above those applied during qualification. However, it was also found that these new levels did not adversely affect the performance of each unit.

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Additional tests were then made to determine what level of vibration each component could withstand and still function properly. These tests led to the conclusion that the self destruct system (including the charge/initiator, battery, discrete/destruct J-box, and separation switches) would operate satisfactorily in flight with no modifications to the existing mounting design. As a result, the positioning of the components in the Thor/Atlas adapter was not changed. As noted in item 1, the mounting of the discrete/destruct J-box in the Titan III B/Agena booster adapter was changed to provide additional confidence in its operation during flight. No other changes to the self destruct system of this unit were made or found to be necessary by the tests.

3. Retrorocket Igniter

Due to several acceptance test failures, the most recently manufactured lot of these igniters was rejected. The cause of these failures could not be determined in time to support existing flight schedules so action was taken to utilize another igniter for the retrorockets. The igniter selected has been tested and flown, and is considered to be a significant improvement over the existing design. The electrical changes and tests necessary to qualify this igniter for use on the Agena are presently being determined. The first retrorockets using the new igniter are scheduled to be delivered in September 1966.

4. Strengthened Booster Adapter

Early in the reporting period, redesign of the vehicle aft tank skirt and Thor/Atlas booster adapter were initiated to increase their structural capability. The aft tank skirt thickness was increased from .110 to .125 in. while the adapter skin thickness was changed from .143 to .160 in. Both of these design changes have now been completed. The aft skirt change will occur at AD-166. The existing booster adapter will be deleted from the vehicle at AD-166 and will subsequently be manufactured as an optional kit. All of the optional kits will contain the new .160 in. thick skin adapter.

The FACI of the new booster adapter optional kit was conducted during June 1966. The only serious discrepancy discovered involved the material which was used to fabricate the first unit. It was found that this material contained inclusions of a flux used in the manufacture of magnesium. Due to improper process control, the flux was permitted to flow into the magnesium ingot. This produced voids in the ingot which later appeared as laminations in the rolled magnesium sheet. These laminations were later discovered in other booster adapters which had been manufactured subsequent to the first unit, and in some of the sheet stock which had been obtained from the vendor. Action was taken by the contractor to determine the condition of all of the suspect magnesium and place a new order for sheet material from another supplier. A structural analysis of the adapters already manufactured indicated that three units are satisfactory for flight use. This should provide sufficient adapters until additional ones can be manufactured from the new lot of material.

5. Zipcord Program

The effort on this program was initiated in early 1966. The objective is to provide a vehicle separation system which, produces less particle contamination and lower shock levels than the existing primacord system. It is intended to accomplish this goal by using the zipcord concept, in which the vehicle separation joint, is severed by igniting mild detonating fuse (MDF) inside an elastic tube.

The main emphasis during this report period has been on the development of a satisfactory joint configuration. Several joint geometries, jacket materials, and charge (MDF) weights have been tested, using flat and curved panels, in order to accomplish this goal. Difficulty was encountered in obtaining a joint which was not too sensitive to charge weight and reliable shock measurements. Near the end of the report period a joint utilizing a centered fracture notch and a hybrid (dual material) jacket was found which would separate reliably with sufficiently small charge weights and shock levels. This design will be incorporated into a full ring assembly during the next report period. A separation test of this joint and one simulating the strengthened Thor/Atlas booster adapter will then be conducted. These tests will determine if the separation, containment, and shock reduction requirements of the program will be met by the new design.

6. Separation Roller Redesign

The design of the separation rollers was changed at vehicle AD-132 in order to accomodate the increased separation loads of the Titan III B/Agena. It was then determined by simulated separation tests of this vehicle that the friction coefficient had been greatly increased by changing the roller design. An increase had been expected; however, its magnitude was not and no tests had been made to anticipate such an increase. When additional Titan booster tail-off data became available, SP-14 determined that Titan III B/Agena separation would be marginal with the new roller if one retrorocket failed to fire. SP-7 also conducted a simulated TAT separation test with one retrorocket out. This test showed that, under these conditions, satisfactory vehicle separation test could not be achieved. As a result, a second redesign of the separation rollers has been initiated. It is expected that the design, test, and incorporation of the new roller assemblies will be completed during the next report period.

7. Lockalloy Study

With the goal of realizing a significant increase in structural efficiency and a corresponding decrease in vehicle inert weight, the Lockheed Missiles and Space Company (Sunnyvale) has undertaken the development of a beryllium - aluminum alloy-- Lockalloy. Research conducted to date has produced a material possessing the favorable compressive strength characteristics of beryllium in addition to the ductility and formability of aluminum. The task of elevating Lockalloy to the status of a usable engineering material has not, however, been carried to completion. Such a procedural effort, necessary to supplement all prior laboratory work, has not received serious consideration by any appropriate government agency. The reasoning offered thus far has been unclear although the absense of a specific operational requirement may be of significance.

During the historical period of this report, the Aerospace Corporation under the recommendation of the Agena Directorate has completed a study aimed at a timely evaluation of Lockalloy from a metallurgical and a structural standpoint. The results of this study have been recently documented and are reviewed herewith:

a. A meaningful set of mill specifications covering both chemical composition and processing are required to assure material reliability.

b. Additional data is necessary regarding fatigue, weld metal, creep, and corrosion properties.

c. The two areas showing great promise through Lockalloy application are those of welded structures and fastener development.

d. In possessing a very high modulus to density ratio, the material is predicted to achieve a 66 to 75 per cent weight reduction over a comparable aluminum structure. In comparison with beryllium the advantage offered by Lockalloy would be in the area of greater utilization under complex stress.

In assessing the results of the independent Aerospace study and considering the development knowledge presently available, it appears that an operational vehicle system such as the Agena can with preparation incorporate Lockalloy advantageously. The future development of this material will be carefully pursued.

8. Chem-Milling of the Agena Oxidizer Barrel Section

In undertaking to reduce production cost wherever possible, the Agena Directorate approved a process change which adopted the use of chem-milling for the final fabrication of the propellant tank oxidizer barrel section. The latter is a 60 inch cylinder approximately 55 inches in length with a tapered skin-thickness. The original manufacturing procedure consisted of rolling and machining two (2) 6061-T6 aluminum alloy sheets which were then joined by two (2) longitudinal machine welds. This task as described was costly in terms of execution time and the subsequent rework effort which occurred frequently. Specified contour compliance was also very difficult to achieve on a continuing basis.

After a thorough review of the state of the art of chem-milling it was concluded that certain vendors could, indeed, perform a quality etching of the oxidizer barrel section within acceptable tolerance limits. An engineering change was subsequently approved which included a contract cost savings of approximately $46,000 as compared to that of the original machine design. Regardless of certain QC procedural errors which have been encountered, the technique of chem-milling as applied to the Agena propellant tank is considered to be an efficient use of manufacturing technology.

9. Agena Flight Failure

In the early part of May 1966, Agena vehicle #106 failed to separate as programed from a Thor booster during its launch sequence at WTR. Neither vehicle, or portions thereof, were ever recovered. An investigation was immediately undertaken by the Contractor (Lockheed Missiles and Space Company) and shortly thereafter an Air Force Missile Incident Investigation Board was convened to determine the cause of failure and establish corrective measures. The primary area of suspect was the pyrotechnic separation system of the Agena vehicle which consists essentially of a circumferential length of MDF (RDX charge) which is contained within a mechanical joint and terminates at a separation detonator and detonator block assembly. A single electrical connector is secured to the separation detonator and directs current from either one or two sources to two electric detonators within the separation detonator. Either detonator provides a sufficient blast wave to ignite the respective terminal end of the cord. The latter in turn breaks a circumferential joint portion of the booster adapter forward section which is notched to facilitate separation. Flight data revealed no indication of partial or complete separation.

The subsequent investigation carried out by the Contractor (Lockheed Missiles and Space Company) and the Air Force covered every conceivable failure mode associated with the separation system. Several electrical and mechanical compatability tests were conducted as well as individual component verification tests. It was not possible to determine either from flight data or subsequent analyses, a single, most probable failure mode. Nevertheless, numerous items of a corrective nature were recommended and incorporated so as to reduce any possibility of a future separation anomaly. The official findings of the Air Force Missile Incident Investigation Board were documented in a classified report to Maj. General Funk, Hq. Space Systems Division.

10. Determination of Asymmetrical Heating Effects on Standard Agena Vehicles

A program of research has been progressing through this period to develop an accurate method of determining the effects of asymmetrical heating as experienced by the Agena during the execution of a dog-leg trajectory. The work undertaken to date has been varied yet complementary and is described as follows:

a. A series of wind-tunnel tests have been conducted at AEDC to measure the heat transfer rate and coefficients as a function of angle of attack and angle of roll for two vehicle configurations. This work and associated analysis are in progress. 20% of the test effort remains.

b. A test effort is also presently in progress to measure the thermal stress distribution around a theoretical equivalent of the Agena booster adapter. The temperature and stress distributions throughout the shell will be experimentally determined for various load and thermal conditions.

c. A computer program has been developed using general cylindrical shell theory in order to analyze thermal stress effects on structural buckling capability. This program is presently being "debugged."

d. As an empirical check a buckling test program is soon to commence at the Contractor's Palo Alto research facility. These tests will determine the failure load of the shell specimens when subjected to various asymmetric temperature environments. The technique of buckling-capture to be used in this phase of testing will insure repeatability of data and accordingly, accurate results.

The period of this report has, therefore, been devoted to the gathering of basic data and the setting up of equipment for structural testing. The period till the end of the year will be devoted to the collection of all test data and the analysis of same Due to funding restrictions, however, the latter will not be carried out as planned but rather delayed somewhat in its completion. The achievement of all objectives will permit the determination of mission versatility of existing designs and the efficient structural design of new configurations.

11. Thorad-Agena

A new booster design has been developed by Douglas Aircraft and consists basically of a SLV-2A with increased propellant capacity. The Thorad's performance will be significantly improved over that of the SLV-2A in terms of having the capability to orbit approximately 450 additional pounds of payload into a 100-400 NM circular orbit.

To date engineering effort has been expended to establish the compatability of the Agena upper stage with this new booster. Of concern to this office has been the analysis of the predicted longitudinal oscillatory effect, referred to as POGO. This resonant condition between the vehicle's first structural mode and that of the propulsion feed system has been predicted by Lockheed (Sunnyvale) to exceed the established maximum environment (total acceleration) for the SLV-2A booster. As such the margins of safety for high stress trajectories are largely negative. Initial flights of this configuration will therefore be normal and extensive instrumentation will be installed so that actual flight data can be subsequently used to revise as necessary the mathematical analysis for POGO. The coordination of several contractors will be involved. In the future it is hoped that a strengthened vehicle and a more accurate mathematical model will relieve any hesitation regarding structural capability for a given mission.

12. Plumbing Improvement Program (Flared Joints)

With the objective of significantly reducing plumbing leakage aboard the Agena vehicle, several steps have been taken to improve both the component quality and the installation procedures as related to the hydraulic and pneumatic systems. The following is a brief review of individual improvements that have been taken to date:

a. A complete series of qualification tests were conducted to determine the capability of the Wiggins "DL" connector as compared to the existing "B"nut design. The results of this program have been documented; however, as the design was susceptable to fretting corrosion together with a high level of stress concentration at the base of the flare, several failures were experienced. The design was, therefore, considered not qualified for flight. It is noted though that the torque retention characteristics of the lubricated design were very good and under static conditions, it is judged to be better than the existing nut and sleeve design.

b. The Contractor's purchasing specifications for both aluminum and CRES tubing have been rewritten to insure the procurement of a high quality product in each case. The helium quality CRES tubing and the hydraulic quality aluminum tubing result in a good finished part with little scrapage.

c. The Lockheed Missiles and Space Company has, with NASA assistance, developed a method of producing a very clean and geometrically perfect tube flaring process. The orbital flaring technique is now in production use.

d. All existing AN and MS plumbing fittings are being replaced with high-quality MC parts.

c. Other significant improvements have been in the areas of handling, inspection, and acceptance testing of plumbing components.

The introduction of these improvements to the plumbing system of the Agena vehicle has done much to relieve the launch base personnel of continually correcting leaking joints. Moreover, longer life capability for orbiting vehicles has been improved.

13. Incorporation of Permanent Joints on the Standard Agena Vehicle

In acknowledging the deficiencies of separable connector design, the Standard Agena Directorate has initiated a development program to incorporate permanent joints into the vehicle's plumbing system. The induction brazing method as developed by McDonnell Aircraft and subsequently licensed to the Aeroquip Corporation has been in operational use and was judged to be best suitable for Agena application. The tasks carried out to date have been preparatory in nature and are described as follows:

a. The Air Force has procured an assembly of induction brazing equipment at a cost of approximately $50,000 for Agena production use. This equipment has been delivered to Lockheed (Sunnyvale) and is presently being used for training purposes.

b. Work is near completion to update an Agena mock-up vehicle to a future, structural configuration, AD-178. This vehicle will then be used to perform an accurate and an acceptable mock-up of all Agena tubing so that either a permanent joint may be brazed in place or an orbital flare may be produced without interference on all remaining separable joints. The adoption of either one or the other design has been based on maintaining component qualification status initially. As such it is predicted that approximately thirty (30) joints will be brazed at first.

c. Engineering work is now proceeding to finalize the design drawings, the development test plan, and appropriate Preferred Parts pages for each required fitting. A specification has also been written for the induction brazing of tubing and fittings.

d. To insure design adequacy several conceptual design reviews have been conducted to date. Using program compatability has been achieved and all requirements coordinated.

During the last half of this year specific attention will be devoted to the development and qualification test phases of this program. The establishment of acceptable inspection techniques will also be considered. In time it is anticipated that the vast majority of plumbing connections will be brazed.

Subsystem B

1. Agena Propulsion Performance - During the period of this report 20 Agena vehicles were launched. Eighteen of these used the USAF YLR 81-BA-11 Rocket Engine and two were Gemini-Agena Target Vehicles (GATV) using the USAF XLR 81-BA-13 Rocket Engine. Out of the 18 Agenas which used the YLR 81-BA-11 Engine, six were dual burn configuration and 12 were single burn. Of these 18 vehicles, there were two failures, neither of which was attributable to the engine. In addition, two of the 18 were the last Agena B configurations which will be flown. Out of the two GATV's, one was a failure which was caused by the SLV-3 launch vehicle.

2. USAF YLR 81-BA-11 Rocket Engines - As indicated above these engines continued their excellent flight performance record. Performance during this period was not without anomalies, however, and efforts contume to further refine the reliability and predictability of this engine. Payload requirements have progressed to the point were it is now necessary to predict propellant utilization to within 30 pounds, and one program has demonstrated a ready-for-fire-time capability in excess of three months.

During this period, the first government procured engine flew. While the flight was a mission success, the engine exhibited an anomaly which has been seen on two previous flights. Effort has been initiated to determine the cause of this anomaly.

A follow-on contract was negotiated for 36 more of these engines. Deliveries will continue through November of 1968 under this contract.

3. USAF XLR 81-BA-13 Rocket Engines - Project "Sure-Fire" was completed during this period, culminating with the flight of GATV 5003. On this mission, the primary propulsion system was successfully restarted 8 times. Two more XLR-81-BA-13 Engines were procured to take the place of those used by Project "Sure-Fire".

4. 8250 Secondary Propulsion System - The secondary propulsion system on GATV 5003 was operated 9 times with the Unit I, and twice with the Unit II thrust chambers. Performance in all cases was nominal.

5. 8133 Rocket Engine - Preparation of the resubmission of the development-plan, based on revised funding for this project,was begun.

6. Gas Injection Test Program on the YLR 81-BA-11 Rocket Engine - Effort on this program was completed although the final report will not be submitted until the next reporting period. Preliminary results indicate:

   a. While performance is degraded during gas injection, the engine shows a remarkable tolerance to any harmful effects caused by ingesting gas and performance will recover when the gas ingestion has ceased.

b. Vibration caused by pump cavitation seems to be the worst effect of sustained high gas ingestion rates.

7. Propellant Feed, Load, and Pressurization System - Effort was completed on the redesign of the propellant fill coupling to give it a 15 day on-pad-wet capability. Action was taken to implement the redesigned coupling onto the production vehicle.

A mission failure was caused by the failure of the propellant isolation valves (PIV's) to close between first and second burn on one vehicle. At present, the failure is blamed on the circuitry which controls the PIV's.

The pyro operated helium control valve was redesigned as the result of a structural failure which occurred during a production reliability test. The failure was attributed to stress corrosion and the heat treat on the body of the valve was changed to eliminate the problem on future units.

SSVAC HISTORICAL REPORT, 1 JAN 1966 - 30 JUNE 1966

1. **MISSION** - The mission of the Agena Configuration Management Division (SSVAC) is to apply the methods of Configuration Management, as described in AFSCM 375-1, to the Agena Space Vehicle Program with as few deviations as possible.

2. **PERSONNEL** - Capt James Kington retired due to medical disability. Captain's Carl Miller and Craig Smyser, recent graduates of AFIT's Graduate Systems Program Management course joined SSVAC's staff. Capt Miller is in charge of Configuration Control and Capt Smyser is in charge of Configuration Identification.

3. **ACTIVITIES** - SSVAC processed 76 Engineering Change Proposal actions, 169 specification changes, and evaluated numerous program plans and statements of work. SSVAC personnel assisted in three (3) vehicle acceptance inspections and the .160 Booster Adapter Kit FACI.

4. **SIGNIFICANT EVENTS** - Actions were taken to insure that the 6595th and 6555th Aerospace Test Wings at the two launch bases plus the two range safety offices at AFWTR and AFETR were brought into the ECP coordination cycle in order to preclude range safety problems. The contractors have been directed to forward copies of all ECPs to the 6595th ATW and 6555th ATW. Copies of all ECPs affecting range safety will be forwarded directly to the range safety offices at AFETR and AFWTR. Actions were also taken to insure that NASA's Lewis Research Center at Cleveland, Ohio, is promptly supplied with ECP's directly from the contractor's and sufficient back-up material is attached, to allow them to make timely comments on proposed ECPs. Buying Agena components directly from contractor's and turning them over to Lockheed as GFE is creating new problems: coordinating documentation between various contractor's; integrating configuration management reports that are fragmented by contract and by contractor; in general, attempting to indoctrinate additional contractor's in configuration management requirements.

JAMES C. MARTIN, Major, USAF
Chief, Configuration Management Div.
Agena Directorate

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AEROSPACE GROUND EQUIPMENT DIVISION
1 January - 30 June 1966 SSVRA

1. (U) During the reporting period, the Agena Directorate was reorganized. As part of the reorganization, the Aerospace Ground Equipment Division was designated the "Agena Operations Division." As part of the change, the Division picked up responsibility for the Agena interface with the using programs for Contract AF 04(695)-761, the Santa Cruz Test Base Sustaining Contract, and the Radio Guidance Functions with the contracts associated with this effort. Such contracts are with Western Electric Company and UNIVAC Corporation.

2. (U) The ETR Launch Capability Contract AF 04(695)-936 was definitized during the reporting period. The contract is for the period 1 Jan 66 thru 31 Mar 67, and covers launches from Complexes 12, 13 and 14 at Cape Kennedy. The preceding launch contract AF 04(695)-688 ended with a reported estimated $147,000 net overrun. Inasmuch as the rates have not been settled for the -688, it is not possible to state with certainty the final cost of the effort purchased.

3. (U) The WTR Contract AF 04(695)-689 ran to completion 31 Mar 66 with a total estimated cost of $28,929,999, a net underrun of $1,757,000.

4. (U) The follow-on WTR Launch Capability Contract AF 04(695)-968 was definitized for $30,997,000. The -968 contract covers the period from 1 Apr 66 - 30 Sep 67.

5. (U) Contract AF 04(695)-1054 was negotiated with Univac for approximately $2,050,000. This is the follow-on to the VAFB Operations and Maintenance Contract -706. It provides for Athena and 642B computer programming and operations FY 67 and 68 in support of Programs 241, 770, 206-II, NASA Agena and NASA Delta.

6. (U) Discussions continued with SAC and ADC concerning turnover and utilization of Ground Guidance Station (GGS) No. 6. SAC will vacate this station early in FY 67. The present plan is to move from GGS No. 4 and consolidate SSD operations in GGS No. 6-1 and No. 6-2 late in FY 67. ADC will then occupy GGS No. 4. Firm approval of the plan is expected from ADC during July 1966.

7. (U) Agena Road Shipments.

a. Our program to qualify special "Air Ride" vans for Agena road shipments is complete. Special "Air Ride" vans provide shock and vibration protection required by the Agena; in addition, an increased margin of environmental protection is provided.

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automatically [illegible] declassified
after [illegible] years.

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b. NASA LeRC developed interest in our commercial van qualification program as a result of the uncertainty of Military Airlift Command support of Agena shipments. A complete set of data, along with our findings, was furnished to provide them the required basis for road shipment of Agenas to WTR.

c. The qualification of Commercial Vans for Agena road shipments negates the requirement for building new transporter in the event the present transporters become unserviceable as a result of wearout or changes in Agena configuration.

8. (U) The Pad Modification Integration Working Group (PMIWG) has supervised the modifications to the 72 area complexes during the past six months. This activity has been primarily associated with Thorad modifications on Launch Stands 75-3, 4 and 75-3, 5, as well as Thor AGE Improvement Program modifications and long run cables replacement on all four pads. The bulk of the work in these areas has been completed and chairmanship of the PMIWG has been transferred to the 6595th ATW.

[redacted]

10. ~~(C)~~ Technical and activation management assistance was provided to Program 461 during the conversion of PALC 1, Stand 2 to their use.

11. (U) Continuing support is being provided to the START Program in their activities concerning PALC 1, Stand 2. LMSC support is being provided under the WTR Launch Capability Contract.

12. (U) An AGE Improvement Plan was developed jointly with the Lockheed Missiles and Space Co. The goals of the plan are to generally reduce AGE cost and increase efficiency. The plan is based on use of MIL-D-1000 documentation requirements, more complete systems engineering by the LMSC program offices, and the transfer of AGE engineering responsibility Systems Operations (Dept 76-XX). Coordination and approval was received from all affected AF and NASA program offices. The milestone actions of the plan were closed out with the exception of Item 2, Equipment Definition. Action on this item was delayed until revised launch base procedures were defined. Many of the items were picked up as overall company improvement directives.

GROUP 4
Downgraded at 3 year
intervals; declassified
after [illegible]

Procurement & Production Division
Historical Data
1 January 1966 to 30 June 1966

1. During the period the Procurement Division (SSVAK) supported the Agena Directorate by issuance of 12 new contracts, definitization of 2 letter contracts and administration of 82 active contracts. Total estimated value of these contracts is approximately $535,000,000.

2. Letter contract AF 04(695)-722 with LMSC was distributed on 17 February 1966. The contract was for 57 Agena vehicles.

3. Letter contract AF 04(695)-766 with Bell Aerosystems for 57 Agena Engines was distributed on 5 January 1966.

4. Letter contract AF 04(695)-938 with Bell Aerosystems for 36 Agena Engines was definitized during the period for $4,700,000 (FFP) but is not yet distributed.

5. Letter contract AF 04(695)-939 with LMSC for Agena vehicles became overage as of 30 June 1966. The proposal from LMSC seems unrealistically high and there seemed to be no negotiation flexibility.

6. During the period contract AF 04(695)-754 and related records were transferred to the Burner II Program Office.

7. During the period 4 orders were made against BOA AF 04(695)-589 with LMSC. They are here listed:

    11. Main Elec. Umbilical Redesign
    12. Prep Round #VII
    15. Type III Battery Cell Test
    17. Preliminary Improvement

Total estimated amount of the above orders is $1,385,607.

8. On 1 April 1966 the BTL Radio Guidance System procurement was assigned when the Subsystems Directorate was phased out. One PCO, two buyers, and two clerks were transferred in with related contracts.

9. The launch contracts at ETR and WTR have been successfully negotiated as Fixed Price Incentive contracts. In fact, virtually all new contracts in SSVAK are fixed price or fixed price incentive instead of cost reimbursable.

Edwin H. Higgins

EDWIN H. HIGGINS, Major, USAF
Chief, Procurement Division
Agena Program Office

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Program Control Division
Historical Data
1 Jan 66 - 30 Jun 66

1. Program Office Reorganization

a. The recent reorganization within the Directorate, effective 17 June 1966, changed the "Requirements and Programming Division" to the Program Control Division. As a result, several functions were transferred to other Divisions and some were added. The Reliability function, including PREP and Quality Assurance were transferred with Maj Crawford and Lt Straton to the Engineering Division. The preparation of Statements of Work was also transferred to the Engineering Division with Lt Tubbesing. Capt O'Rourke took with him to the Operations Division the Systems Integration and Interface Control functions. Financial control and funding to support Agena launch services and BTL guidance equipment and services, and Production Management functions were added as a result of the reorganization.

b. Personnel Changes

(1) Mr. Gene E. Stewart, Industrial Specialist, assigned to the Division on 2 June 1966.

(2) Mr. Dale C. Harrison, Industrial Specialist, assigned to the Division on 2 June 1966.

(3) Lt Col William T. Jones was reassigned 15 June 1966.

(4) Maj William R. Bell assumed duties as Chief of the Division on 15 June 1966.

2. LMSC Operating Schedule

LMSC Official Operating Schedule, Issue #29, was distributed on 28 April 1966. The Lockheed schedule depicts the milestones, systems test and launch stand loading for all programs using the Agena vehicle. SSVAP acts as SSD central point of contact for LMSC in coordinating and obtaining approval for the information presented in this document.

3. Non-Flight Hardware

An inventory of non-flight hardware is maintained at LMSC to provide test programs, which are conducted for various reasons, maximum support at minimum cost. A few reasons for these tests are:

a. Simulate in flight failure conditions.

b. Simulate perturbations noted during vehicle checks.

c. Verify new designs.

d. Special development tests for product improvement.

e. Pure research.

This non-flight equipment is also loaned to other DOD and to NASA agencies, thereby obtaining maximum utilization of the hardware and precluding necessity of additional DOD/NASA funds being expended to duplicate existing capability.

4. Standard Agena - Slave Plan

a. In accordance with the direction given LMSC by SSVA letter, same subject, dated 29 June 1966, and CCN 108, MSN-3252, dated 24 June 1966, Standard Agena item of hardware, currently not being used by using programs, will be slaved during the Standard Agena system test cycle. It is currently planned to continue this slave system (except those items of hardware to be replaced by the new GCE Configuration at AD-205), through the -939 contract. This total effort will be accomplished without the benefit of changing engineering drawings, and will be scheduled and controlled by the Standard Agena Program Office in accordance with the Implementation Plan.

b. The hardware to be used for slave units will be furnished LMSC as GFP and painted red for ready identification and will be identified with the contract end item, component part number and unit serial numbers.

c. The estimated savings that will be realized by this slaving, starting with Vehicle effectivity AD-160 and subsequent, will be $1,500,000 through the -939 Contract.

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SSV

Agena Guidance and Control Subsystem Developments (U)

SSGS (Gen Martin)

1. ~~(C)~~ In July 1965, following study and analysis of future development requirements, we initiated the development of an improved guidance and control electronics (GCE) subsystem for the basic Agena. The GCE package is designed to replace the existing flight control, guidance and flight control electronics J-boxes. The proposed program was outlined to potential users in your organization at that time, and oral approval was expressed. Subsequent to July 1965, other related subsystem developments also have been initiated to provide an improved velocity meter cutoff system and a new inertial reference package. A summary of the funds status for these developments is attached.

[redacted]

3. (C) Since you are becoming the sole user of the Agena, I request that you advise me of your intentions. If program peculiar replacements of standard items are to be used on a preponderance of Agena vehicles, then in the best interest of the government all SSV development and production efforts on GCE, Velocity Cutoff System X, and the MIT Inertial Reference Package should be terminated. However, I would be reluctant to take this step because of its impact on the improved Agena. As you know, these guidance and control improvements, when coupled with the new engine, will provide the Air Force with a new standard Agena. Pending final resolution of the apparent duplication, we have Lockheed in a virtual stop-work status on our subsystem developments.

[redacted]

SIGNED

J. L. HARI[illegible], Colonel, USAF
Deputy [illegible] Vehicles

1 Atch
SSV Agena GC Funding Summary

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DOWNGRADED AT 12 YEAR
INTERVALS; NOT AUTOMATICALLY
DECLASSIFIED. DOD DIR 5200.10

SSV AGENA GUIDANCE & CONTROL SUBSYSTEM FUNDING

	Work Started	Invested To Date	Anticipated To Go	
Guidance & Control Electronics	Jul 65	$1.35M	$3.7 - $5.2M#*	Development & Production
			$.635M#	Incorporation & 25 Program Module Kits
Velocity Cutoff System X	Jun 66	$1.725M#		Development & Production
		.013M	.142M	Incorporation
MIT Inertial Reference Package	Nov 65	.455M	.440M **	Development Production & Incorporation
		$3.543M	$6.417M plus IRP Qualification, Production & Incorporation	

* Presently being negotiated. Figures represent offered vs proposed price.
** Estimate $.500M for Qualification and Incorporation costs.
# Includes 25 production units.
#* $1.164M anticipated for Electronic Event Timer not listed.

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DEPARTMENT OF THE AIR FORCE
[illegible]
AF UNIT POST OFFICE, LOS ANGELES, CALIFORNIA [illegible]

REPLY TO ATTN OF: SSVA

SUBJECT: Historical Report- 1 Jul 66 to 31 Dec 66 3 Feb 67

TO: SSV

Attached is one copy of SSVA Historical Report.

CECIL E. RIDDLE, Col, USAF
Deputy Director, Agena
Deputy for Launch Vehicles

1 Atch
Historical Rpt (S) 9 atchs
2, 7, 8, 9 (C)

UNCLASSIFIED

2 (C)
7 (C)
8 (C)
9

DOWNGRADED AT 3 YEAR INTERVALS;
DECLASSIFIED AFTER 12 YEARS.
DOD DIR 5200.10

~~[illegible]~~

Tab 4
SSVA-1920

285

DEPARTMENT OF THE AIR FORCE
[illegible]
[illegible]

REPLY TO ATTN OF: SSVA

SUBJECT: Historical Report- 1 Jul 66 to 31 Dec 66 3 Feb 67

TO: SSV

Attached is one copy of SSVA Historical Report.

CECIL E. RIDDLE, Col, USAF
Deputy Director, Agena
Deputy for Launch Vehicles

1 Atch
Historical Rpt (S)

UNCLASSIFIED

DOWNGRADED AT 3 YEAR INTERVALS;
DECLASSIFIED AFTER 12 YEARS.
DOD DIR 5200.10

SSVA-1920

~~SECRET~~

AGENA PROGRAM OFFICE
Historical Data
1 Jul 66 to 31 Dec 66

1. Col A. J. Gardner assumed duties as Program Director on 1 Aug 66. Col William Nielsen departed on terminal leave 15 Jul 66 pending retirement on 30 Sep 66.

2. During this period 24 Agena vehicles were delivered to the Air Force. Twenty-one vehicles were launched with all being successful.

[redacted]

OPERATIONS DIVISION
Historical Data
1 July 1966 to 31 December 1966

Downgraded to confidential auth: Dir SP-15 29 May 68 subj: Downgrading of Hist Report and [illegible] G Cooper

1. ~~(U)~~ Supplemental Agreement Number 2 to the Santa Cruz Test Base Sustaining Contract AF 04(695)-761 was negotiated in an effort to reduce the sustaining costs. Test Stand Number 2 was closed and Test Stand Number 1 was placed in a 30 day standby condition of maintenance. The net result was a reduction in the contract price of $237,000.

2. (U) Inasmuch as there appeared to be no further Air Force requirement for Agena launch capability at the Eastern Test Range (ETR), it was the intention of SSVA, at the beginning of calendar year 1966, in the absence of direction from higher headquarters, to close Launch Complex 14 after the last Gemini Target Vehicle launch and to turn the responsibility for providing the Agena launch capability at the Air Force Eastern Test Range (AFETR) over to the Agena Project Office, NASA Lewis Research Center (LeRC) at the close of Contract AF 04(695)-936. An informal agreement between SSVAO and the Agena Project Office (LeRC) to the effect that the Agena Project Office (LeRC) would develop a procurement schedule designed to provide the Agena Launch capability at AFETR during the period 1 Apr 67 - 31 Mar 68. The reservation of the right of the Air Force to retain the procurement responsibility if an Air Force launch requirement subsequently developed was recognized by both parties. The NASA LeRC Agena Project Office, in accordance with the agreement, established a procurement schedule and proceeded to prepare for the procurement. Meetings were held between the contractor and LeRC, and between SSVAO and LeRC; work statement discussions were held in which all interested offices participated including SSVAO. The NASA LeRC Agena Project Office ultimately completed a procurement package which was sent through NASA channels for approval. Before approval was granted for the procurement by NASA Headquarters, an Air Force requirement was announced. NASA was notified of the AF requirements and told that SSVA would proceed with the procurement of the Agena Launch Capability. SSVA had anticipated an Air Force requirement, so SSVAO and SSVAK had been developing, in parallel with NASA's effort, an Air Force procurement package, so that when the Air Force requirement was made known the last week in October, SSVA was prepared, and RFP 04695-67-R-0063 was issued on 2 Nov 66. On 20 Dec 66, the Air Force received the contractor's proposal. It is anticipated that a definitive Agena launch contract will be issued by 1 April 1967.

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DOWNGRADED AT 3 YEAR INTERVALS;
DECLASSIFIED AFTER 12 YEARS.
DOD DIR 5200.10

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SSVA-1920

3. (U) The overrun on AF 04([illegible])-645 has not been resolved. It now appears the overrun will be only about half the amount originally reported.

4. (U) SSVAO has been operating at 70% of authorized strength since 1 Jul 66. Major Elmer T. Davis, Jr. has been Acting Chief of the Division since Lt Col Edwin Senkbeil retired 30 Jun 66.

5. (U) During the past year numerous problems were encountered as a result of poor quality of WECo waveguides. We reviewed the contractor's waveguide manufacturing process and recommended changes. WECo incorporated essentially all the changes that were recommended in the quality control of dip braze salt condition, process water acidity and handling time between sulfuric acid quench and Allodine treating. This resulted in a decrease from 30% to less than 2% in-plant rejection and no subsequent waveguide problems.

6. ~~(C)~~ (Gp-4) A Complex Modification Working Group was established under the chairmanship of SSVA/SSVX to supervise and control the modification of SLC-3, West to a Thorad/Agena capability. The group was established by SSVA at the request of the 846 Program Office on 16 Nov 66. The present schedule calls for a complex access date of 15 April, with all demonstrations complete by 22 Aug 67.

7. (S) (GP-4) VAFB Ground Guidance Station (GGS) 6 was turned over [redacted]

b. ~~(C)~~ The SSD/ADC agreement provides that ADC (SMAMA) will provide an updated 1230 computer in exchange for the 642B, which is to be left in GGS 4 for ADC. This arrangement was necessary in order to keep GGS 4 operational while a surplus IOC radar and the 1230 computer were being installed and checked out in GGS 6. A program, which is scheduled to fly on the TIIID, requires the capability of the 1230 computer due to the short reaction time.

c. (U) The radar system in GGS 4 was designed and manufactured in 1958 for a Titan ballistics mission. There has never been an opportunity to put the system down in order to refurbish and replace obsolete wiring and components and also remove unused circuitry and components. Considering the present known usage, into the 1970's, a significant reliability problem could result. The radar system to be installed in GGS 6 will be refurbished and modified to the required SSD configuration which will avoid this potential problem.

d. (U) It had previously been established that SSD required two guidance stations due to the operational load. This was the basis for GGS 6 being turned over to SSD.

8. (U) Significant activities and problems associated with the move into GGS 6 are as follows:

a. (U) Surplus Titan radar systems were received at VAFB from Larson, Ellsworth and Lowry AF Bases. A number of critical components are missing which were apparently lost when several classified units were removed by SMAMA. A requisition for the missing items was forwarded to SMAMA.

b. (U) Agreement was reached with SMAMA for procurement of the 1230 computer.

c. (U) The required facilities were identified and a schedule established with SSN for implementation. The facility modifications and additions will be critical in meeting the overall schedule.

d. (U) The capability to support Program 846 from GGS 6-2, the south half of the station, was established in October using the existing radar and Athena computer.

9. (U) Bell Telephone Laboratories, Western Electric Co and Aerospace/Univac accomplished separate validations of the TIIIB guidance program on the Univac 642B computer in GGS 4.

10. (U) The first two TIIIB launches were automatically aborted within 10 seconds of launch, by a malfunction in the guidance computer. In both instances, the second countdown and launch were completely successful. After an intensive technical review, a number of improvements were made in the 642B computer and the radar interface unit, both of which are provided by Univac.

11. (U) The Guided Missile Test Station, which will replace a laboratory model on SLC-4, West and the Missile Guidance Simulator, which is used in Titan production testing, were given First Article Configuration Inspections in support of the TIIIB program.

12. (U) Agreement was reached with the Western Electric Co, the Martin Co and SSB on format for Personnel Equipment Data for launch pad, radio guidance maintenance and operations. This is required in support of the blue-suit operation to be implemented for the TIIIB.

13. (U) Activities in support of the proposed TIIID were as follows:

a. The GFP (WECo) hardware and data requirements have been negotiated with the Martin Co and SSB to include GFP equipment to be shared with TIIIB.

b. Preliminary Interface Specification and Interface Control Drawings for TIIID/Radio Guidance have been defined by Martin Co and WECo.

c. WECo was provided contractual coverage to support Project Seethru, which is an experiment to measure attenuation of S and X band frequencies by solid rocket motors.

d. WECo (BTL) was provided contractual coverage to provide a radio guidance Error Analysis and Injection Accuracy Report.

e. SSVAO prepared a Work Statement for the procurement of the Radio Guidance and Targeting equation for the Titan IIID launch vehicle. The Work Statement was to investigate, develop, and validate in detail accurate and flexible guidance and targeting software.

[redacted] ~~[illegible]~~

(1) This effort would be a substantial change from the present BTL equations. The present equations are peculiarized to a specific vehicle and rely heavily upon a predetermined nominal trajectory.

(2) The new software would include rapid targeting capabilities, little reliance on the nominal trajectory, explicit steering techniques, a dynamic thrust model, and an optimum noise filtering technique. As a consequence of these improvements, the guidance computer storage capacity requirements would be reduced.

(3) The Statement of Work has been completed and may be submitted to the contractor when funds are provided for the Titan IIID effort.

14. (U) The implementation of the program to provide back-up range safety data to the range was delayed due to the failure of the WTR to validate the data link between the guidance station and range operations (Bldg 300) at the WTR.

15. (U) The responsibility for the WECo and Univac radio guidance operations and maintenance contracts at the Eastern Test Range was formally transferred to Goddard Space Flight Center (NASA).

16. (U) The request for proposal for a follow-on buy of radio guidance hardware specified uniform configuration management requirements which would be implemented in support of all using programs. Most of the specifications developed under the -811 contract in support of TIIIB will be used as is. The program will be based on each using system (Titan, Thor or Agena) maintaining responsibility for the booster/guidance interface documentation.

17. (U) Completely successful WECo/Univac radio guidance operations were conducted in support of twelve 846, 110, 770 and NASA Delta missions.

18. (U) The Aerospace Ground Equipment development activity continued at a low level due to:

a. No new activations or major modifications.

b. The remaining Agena using programs have acquired experienced personnel and also have Aerospace Corporation on contract for Systems Engineering and Technical Development. These programs are also using established test and launch facilities which normally require only flight-to-flight configuration changes.

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SSVA-1920

Procurement [redacted] Division
Historical Data
1 July 1966 to 31 December 1966

1. During the period the Procurement Division (SSVAK) supported the Agena Program Office by issuance of 7 new contracts, definitization of 1 letter contract and administration of 87 active contracts and 17 Basic Ordering Agreement Orders. Total estimated value of these contracts plus actions in process is approximately $590,000,000. Major contracts are Lockheed Missiles and Space Company, Bell Aerosystems Company, Barnes Engineering Company, Western Electric Company, and Univac Division of Sperry Rand. Other contractors are Massachusetts Institute of Technology, Belock Instrument Corporation, Quantic Industries, Inc., and Autonetics Division of North American Aviation. One Contracting Officer also is the Procuring Contracting Officer on AF04(695)-754, the Burner II Program with Boeing.

2. During the period 10 contracts (which were complete and all final documentation received) were transferred to records storage.

3. Letter contract AF 04(695)-938 with Bell Aerosystems for 36 Agena Engines was distributed on 30 September 1966.

4. Letter contract AF 04(695)-939 with LMSC for Agena Vehicles has been overage since 30 June 1966. Negotiations were held from 2 November 1966 to 16 December 1966 but no agreement was reached. The Air Force awaits Lockheed's response to the Air Force offer.

5. Letter contract F04695-67-C-0071 with LMSC for 25 Agena Vehicles was issued in December 1966 but is not yet distributed.

6. During the period, 3 orders were made against BOA AF04(695)-589 with LMSC. They are here listed:

16. Electronic Event Timer
18. Production Qualification Program
19. Logistics Support and Repair

Total estimated amount of the above orders is $2,150,000.

7. Order #2 to BOA -550 with Bell for repair of an 8096 engine for $49,000 cost was also issued.

8. Much effort was exerted to reduce the number of overage CCNs with some success. In October 1966 the zero overage point was reached but some in letter contract AF04(695)-939 are now overage and can't be definitized until the contract is definitized.

9. One buyer retired for physical disability and is being replaced soon by a buyer from the Gemini Target Vehicle Program Office. The Division will be completely staffed with a Division Chief, two Contracting Officers, seven Buyers, four Procurement Clerks and one Clerk Typist.

Edwin H. Higgins

EDWIN H. HIGGINS, Major, USAF
Chief, Procurement Division
Agena Program Office

Program Control Division
Historical Data
1 July 1966 to 31 December 1966

1. Program Requirements

a. During the reporting period NASA Lewis Research Center cancelled their requirement for the second PAGEOS mission and ordered an Agena vehicle for the SERT-II program.

2. Personnel Changes

a. Capt G. Sloan was reassigned 7 November 1966.

b. Helen D. Shalita, Secretary-Steno, assigned to the Division on 5 December 1966.

3. LMSC Operating Schedule

LMSC Official Operating Schedule, Issue #30, was distributed in October 1966. The Lockheed schedule depicts the milestones, systems test and launch stand loading for all programs using the Agena vehicle. SSVAP acts as SSD central point of contact for LMSC in coordinating and obtaining approval for the information presented in this document.

4. Cost Reduction

a. Reduction of Santa Cruz Test Base Facilities

(1) The Santa Cruz Test Base consists of laboratories, ordnance testing facilities, and three engine test stands. Two of the test stands are operated for the Agena program by LMSC under Contract AF04 (695)-761. The current contract period of performance is from 1 July 1965 through 30 June 1967 and calls for Test Stand #1 to be in a fully operational status and Test Stand #2 to be in a thirty day standby status. This operation was justified based on the existing and anticipated workloads at the time of contract negotiations.

(2) Present conditions no longer justify the maintenance of both stands. Termination action has been taken to deactivate Test Stand #2 and to place Test Stand #1 in a thirty day standby status. There are no plans to reactivate Test Stand #2.

(3) The contractor has submitted a credit cost proposal on the -761 contract in the amount of $237,217.

5. Agena Production Authority

On 4 November 1966, SSVA received DDR&E approval to procure an additional 25 Agena Vehicles for the period April 68 through April 1969. This is a follow-on buy to contract AF04 (695)-939.

SSVAC HISTORICAL REPORT, 1 JULY [illegible] - 31 DECEMBER [illegible]

1. MISSION. The mission of the Agena Configuration Management Division (SSVAC) is to support the Program Director, Agena Program Office in assuring adequate contractor management by monitoring and enforcing the 375 discipline.

2. PERSONNEL. The Configuration Management Division continues to operate with a shortage of personnel. In August Captain Carl Miller was recalled to the cockpit with no replacement being supplied. During this period the Chief of the Configuration Management Division, Major James Martin, retired and was replaced by Major Kimerlee Bradford. Mrs. Vera Wells a secretary, took two months sick leave and then retired with no replacement being found.

3. MAJOR EFFORT AND ACCOMPLISHMENTS

A. LMSC Contracts

(1) Program Status Report. Upon becoming Chief, Major Bradford immediately analyzed the LMSC configuration status and made several Air Force presentations depicting his evaluation and recommendations for necessary action to insure effective contractor implementation of Configuration Management precepts.

(2) 589 and 695 Contracts. The 1964 version of 375-1 was required on all new specifications being prepared under these contracts.

(3) 722 and 939 Contracts. The 722 contract was generally limited to routine monitoring during delivery of the last vehicle. The 939 contract required extensive effort in support of the fact finding and negotiations. An incremental FACI was held on the Brazed Plumbing incorporated at the beginning of this contract.

(4) Guidance and Control Electronics Contract. This contract required major effort to: define and redefine the requirements of the proposal; support the numerous fact findings required; and to participate in the extended negotiations. The contract is attempting to impose full configuration management requirements on the contractor.

B. Barnes Contract. The Horizon Sensor FACI was held in October and the configuration management office made a thorough audit of the total configuration management structure in order to assure correct implementation of this new direct buy. A satisfactory configuration plan has been established and the Part II of the specification has been approved.

[redacted]

C. Bell Contracts

(1) 766 and 930. The 766 closed out and the first 930 deliveries were made. The Part II of the engine specification was finally delivered for review. The four specifications for the Start Kits are being prepared. The engine configuration management plan is still unapproved.

(2) 1044 Contract. The development and production contract for the Mod X Velocity Cut-Off System was negotiated during this period. A configuration management plan is being prepared to show full compliance with the contract requirements for a configuration management system.

D. Western Electric Contracts. In order to provide a uniform purchasing policy the Western Electric contracts are being brought under one contract and the configuration division is taking an active part to insure full configuration compliance across the board.

E. General

Interface. With the diversification of contracts, and the increasing amount of Government Furnished Equipment being supplied LMSC, the need for more formal interface procedures and working groups is becoming obvious. The configuration management division is taking action to establish such procedures and organizations.

4. MAJOR PROBLEMS

A. Change Proposals. The quality of the engineering change proposals continued to lower during the last half of 1966. During the early third-quarter the contractor supplemented these inadequate submittals by long presentations before the Configuration Control Board. In order to assure more efficient functioning of the CCB the contractor has been excluded from attendance and ECP's which do not contain sufficient data to be fully evaluated are being returned to the contractor. To assure more standardization in Air Force requests for ECPs, an ECP "Request for ECPs" has been prepared.

B. Waivers. The number of waivers per vehicle continues to increase, reaching a high of eight for vehicle 172. No vehicle during the last six months has been bought by the Air Force without a waiver. In order to reduce waiver processing time and insure a common understanding between AFSSD, AFPRO, and LMSC, Major Bradford wrote a Supplement to USAF Specification Bulletin 515. In conjunction with this, the contractor has been required to submit waivers for one vehicle at a time and fully substantiate the problems in order to provide a complete file for future action.

C. Specifications. LMSC has been preparing a new specification to the June 1964 375-1 for the first time. Due to the lack of any Configuration Control of the Specification Section the submittals have been almost totally inadequate and have required numerous revisions, thus increasing cost substantially. The lack of proper internal procedures and coordination is vividly reflected within the specification group where numerous specifications and USCN's have been released without Air Force approval and in direct violation of 375-1 and the contract.

D. Organization. The LMSC Agena Program Office has no configuration manager. Instead the configuration functions have been split up between three different individuals working four levels removed from the program manager. This isolation of the configuration functions from the managing level of the program has resulted in total unawareness of proper configuration management compliance within the program office.

E. Travel. The restriction on travel funds is hampering the effectiveness of the configuration management activities due to the fact that effective configuration management requires continual contact with the contractor. This is necessary in view of the continual need to perform periodic audits of the contractor's engineering release system.

F. Status Accounting. The contractors status accounting reports following the 375-1 format have long proved inadequate. This office has therefore submitted a revised Form 9 to AFSC. Approval of this revised format will provide more adequately the needed information.

ELECTRONICS BRANCH, AGENA ENGINEERING
Historical Data
1 Jul 66 to 31 Dec 66

1. Manning

Authorized Engineers	5
Assigned Engineers (as of 31 Dec 66)	4
Estimate for Jun 67	3

Capt Bergmann is a projected loss in May 67.

2. The following outlines principal efforts since June 1966.

a. Command Destruct System

Late in June, LMSC, at Air Force direction, submitted a program plan to modify the destruct system. The modification was to consist of limiting the current surge by the use of a high resistance wiring in the receiver-to-destruct-unit wire harness. Limiting the surge current to a lower level limits the drop of battery terminal voltage. Several fixes were considered possible: Design a new battery, use separate batteries for the receiver and for the destruct unit, redesign the receiver to operate at 9 volts, or limit current with a discrete resistor. The current limiting wire harness was chosen because it had the least impact on the overall system design and flight qualification status.

Design and qualification information was presented to ETR on 30 Sep. ETR approved the design concept, but insisted that the battery and receiver specifications be made compatible with respect to terminal voltage/input voltage.

b. SGLS (Space Ground Link Subsystem)

[redacted]

[redacted]

SSD has been developing SGLS as the Standard Tracking, Telemetry and Command System. It was flight tested satisfactorily in 1966.

SSVAE and LMSC have been coordinating with using programs to integrate SGLS into the Standard Agena. The using programs have indicated that they do not desire to procure SGLS as Standard Agena equipment.

c. Babcock Relays - Cracked Contact Springs

All latching and some lots of non-latching 10 ampere relays subjected to 30g sinusoidal receiving acceptance screening test at LMSC between 14 Feb 66 and 16 Aug 66 were suspected of being over-stressed due to excessive G-loading. The failure mode that was exhibited was cracked and broken contact springs. It was determined that the test shaker was not under control and was overshaking the relays in worst case conditions in excess of 60 gs. Corrective action was to discontinue the sinusoidal acceptance screening test at LMSC and impound all suspect relays in receiving, stock and stores, and to retrofit Standard Agena black boxes that contained the overstressed relays. A program plan has been generated to qualify a 10 ampere latching and non-latching relay to the requirements of MIL-R-39016. LMSC has sent out request for quotes to six relay vendors.

d. Primary Batteries - Reduced Capacity

Type 1-H Batteries have exhibited lower than normal voltages while undergoing load checks performed during vehicle checkout. It appears that the batteries are losing the capacity normally associated with the peroxide region. In the case of the 1-H battery this amounts to 3 to 30 Ampere Hours. This same problem was reflected with Type 1-C batteries in the form of failing voltage spread requirements and surge tests requirements. An investigation of the vendor quality control procedures was conducted resulting in several recommendations for corrective action; however, no specific cause could be determined which would explain the reduced capacity of the batteries. Investigation is continuing.

e. Type 1-H Battery

Cell testing was initiated 30 Aug 66, using excess electrolyte over a range of high and low temperatures to investigate the possibility of cell capacity improvements. Thermal capacity and heat generation tests also were run on one battery to gain additional information on the thermal characteristics of the battery. The final report has not been submitted at this date.

f. Battery Developments

(1) Type XIV High Energy Battery - This development was terminated due to the failure of cells to meet the minimum requirements delivering 825 ampere-hours while undergoing specified discharge load profiles over the temperature range of 30°F - 100°F. The most probably cause of failure was anode passivation.

(2) High Energy Lithium Chloride Battery - An unsolicited proposal was evaluated on a high energy capacity medium to low rate lithium-cupric chloride battery employing non-aqueous organic electrolytes.

(3) Fuel Cells - A 550 watt-hr per pound fuel cell for unmanned Air Force orbiting vehicles is under development through R&TD with SSVA funding and systems requirements support. It has completed the study phase and is proceeding into design.

~~[illegible]~~

HISTORICAL REPORT
1 July 1966 - 31 December 1966
Systems Branch
SSVAE-2

1. ~~(C)~~ **Agena Flight Summary.**

As of 31 December 1966, there were 227 launches of the Agena Space Vehicle. Of this total, 134 have been of the current Agena D or Standard Agena configuration. The overall ascent success ratio of the Agena D vehicle now stands at 93%.

2. **Production Reliability Evaluation Program.**

During this period the Production Reliability Evaluation Program (PREP) testing of Agena components and selected program peculiar components continued. PREP Round VI was started in September 1965 and as of 31 December 1966, it was about 99% completed. Round VII was started in April 1966 and as of 31 December it was about 73% completed. Planning for Round VIII was initiated in February 1966 and was terminated 21 July 1966 when it was decided to re-orient PREP toward a Production Qualification Program (PQP). PQP Round I should begin in early 1967.

3. **Statement of Work Preparation.**

During this time period, the following work statements were prepared and submitted to the Agena Contracts Division (SSVAK) for contractual action:

a. Agena Electrical Event Timer

b. Autonetics Technical Assistance Program

c. Agena Engineering Support Contract (Follow-On)

d. Agena (Bell) Engine Production Contract (Follow-On)

e. Agena Production Contract (Follow-On)

f. Horizon Sensor Production Contract

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STANDARD AGENA SPACE
VEHICLE TECH DESCRIPTION LMSC-A397740

Maj. Crawford
SSVAE-2
Agena Flight
Summary
Rpt.

LMSC B001675

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1017a

g. Barnes Engineering Company Repair and Engineering Services Contract.

h. MIT Technical Assistance Contract.

i. Agena Coupling Improvement Program

j. Agena Propulsion System Three Start Kit

k. Production Qualification Program.

During this reporting period a new technique was originated in the preparation of Work Statements. This technique consists of utilizing standard phraseology previously approved by the cognizant SSD Staff Organization and the incorporation of a standard format to facilitate review of work statements by both the contractors and Air Force offices. This office has also adopted the policy of preparing all work statements segments except the actual detail procedures and tasks required by every individual effort. This requirement section is furnished by the respective Responsible Engineer and is then molded into a frame-work of associated work statement requirements necessary to assure proper completion of the tasks.

[illegible]. Proposal Evaluation and Contract Negotiation.

This office has been assigned the responsibility of evaluating contractor proposals and when needed, participation in contract negotiations. Tasks performed under this job heading include:

a. Detailed Cost Proposal Analysis

b. "Fact Finding" Activities

c. AFPRO Consultation

d. Learning Curve Analysis

e. Preparation of Air Force Position.

In this reporting period we assisted in negotiation of the following contracts:

1. Agena Production Follow-On Contract

2. Several BOA (AF04(695)-589) orders.

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9. Engineering Management

The previous report made reference to the three problem areas of immediate concern to the Engineering Management Office (EMO): Work simplification, time dissipation, and the dissemination of information. During this reporting period, due in large measure to the increasing acceptance by the "technical people" in the division of the services offered by the EMO, considerable progress has been noted in all of these problem areas through the active participation and cooperation of our technical personnel. At the close of the reporting period, the activity receiving the closest attention by the EMO was the bi-weekly Support Engineering Contract Technical Direction Meeting. These meetings represent the condensed culmination of the bulk of the time (and effort) being invested by both Air Force and contractor Agena managers and technical people. It has become evident that positive control exercised over these meetings -- particularly with respect to agenda topics accepted prior to the meeting and the wording of official minutes thereafter -- yields tangible managerial, contractual and monetary rewards for the Air Force.

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HISTORICAL REPORT

1 July 1966 - 31 December 1966
Subsystem D (Guidance [illegible])

1. DEVELOPMENTS

1.1 New Horizon Sensor Concepts

1.1.1 The Belock Instrument Corporation continued their development of a "Solid State Horizon Scanning Technique" under Contract AF 04(695)-904. The objective was to develop and demonstrate a specific photo conductive detector for use with the Belock Solid State Light Beam Scanner. However, Belock has experienced difficulty in meeting this objective and may not achieve it. The development is behind schedule. Contract completion may be delayed until March 1967.

1.1.2 The Quantic Industries development of a "High Accuracy Horizon Sensor System" continued during this period under Contract AF 04(695)-918. The technical objectives of this development will be attained; however the program is six months behind schedule. This is due to the technical problems and piece part delivery problems encountered during the development phase. Quantic is presently assembling a three-tracker horizon sensor system and fabricating a horizon simulator. These tasks and final system testing should be completed by March 1967. Tests results and final reports should be available in April 1967.

1.2 Guidance and Control Electronics (GCE)

The work effort on the GCE Package under way at LMSC was drastically reduced during the period of 11 July 66 to 26 Sept 66. This was due to a shortage of funds on the Contract AF 04(695)-695. After the "Go-Ahead" was given it was found that the team originally working on the GCE Package had been scattered to other projects and over half would not return. This delay cost approximately four months in schedule alone. The third version of the GCE proposal was delivered to AF in early October. This proposal reflected the removal of the reliability demonstration. This tentatively recouped some of the lost time but not all, hence, the planned vehicle effectivity incorporation was delayed. The year closed with the AF and LMSC negotiating on the contract with a planned start work date of 1 January 1967.

1.3 Inertial Reference Package (IRP)

MIT continued the design of a three-axis, Strapdown IRP for use in the Agena Guidance System. During this period MIT completed the Single-Axis prototype and began fabrication of a three-axis design proof unit (DPU). Emphasis in the DPU development has been towards closer coordination of the interdependent activities which effect initial fabrication. Such activities include circuit optimazation, procurement, reliability and packaging. One major objective in this respect has been to establish weld schedules for each material, combinations of different materials and thickness combinations in advance of IRP parts welding. Additionally, precautionary measures were instituted to assure maximum reliability throughout the fabrication procedure. Present schedule calls for completion of DPU fabrication and functional testing by July 1967.

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1.4 Mod I Velocity Cut-Off System

Formely the Digital Velocity Meter System, Mod I, this system was renamed to prevent any possible confusion with its individual components or the unit it succeeds. The development portion of this program is nearing completion with the Preliminary Design Review scheduled for early January 1967 and Qualification Tests in July. The first production unit will be available in August 1967.

1.5 Electronic Event Timer

On Nov 9 LMSC presented their EET concept in accordance with AF BOA. It was immediately evident that their concept was dictated by short schedule rather than good engineering practice. All further effort was stopped and the S.O.W. was revised to include a thorough study phase. A new RFP was issued in late December. Barring any further complication the first production units should be available by mid - 1968.

MAJOR PROBLEMS

2.1 Sequence Timer

2.1.1 Improved LICON Switch. The first 100 new switches went into test in October. Early test results indicate a definite improvement over the present switch. A change in the plating process and case material have seemingly overcome the two major switch problems of silver migration and foreign material contamination. None of the switches tested experienced a short or open circuit as was common with the previous switch. An ECP to incorporate the new switch has been submitted.

2.1.2 Time "Skippage". A major problem encountered during manufacturing testing of the Sequence Timer Assembly has been that of event timer "skippage". The time of event actuation is changed by decade increments (usually 10 seconds) from nominal because of pinion gears slipping in between or riding over the transfer teeth on the counter wheels, rather than advancing the next counter wheel one increment. When this occurs, counter wheels may be damaged, the cam follower shaft bends and the switch actuating pins may not operate correctly. The following changes are now in progress to eliminate this problem:

a. Redesign cam to require less torque for switch actuation.
b. Install stiffening rings to prevent flexing of pinion gear and cam follower shafts thus providing a better gear mesh.
c. Redesign counter wheels to provide better mesh with pinion gears.

These changes along with the improved LICON switch represent an interim fix being made pending incorporation of the Electronic Event Timer now under study.

2.2 Nitrogen Regulator

An in-flight anomaly occurred in October when a Sterer Nitrogen Regulator failed while being switched from low to high mode of operation. Re-creation of the flight events in the laboratory showed that a simultaneous firing of ullage rockets caused a high demand on the system while the mode switching was in progress. This led to a build-up of pressure in the dome cavity and failure of the main poppet actuating arm. A retrofit program now in progress involves installation of a by-pass line across the failure point to prevent uneven pressure build-up. The lever arm which failed will also be strengthened. Similar tests conducted on the Whittaker Nitrogen Regulator showed that it was not susceptible to this malfunction.

3. PERSONNEL

The Guidance and Control Branch is now operating with four of its six authorized officers. Two of these joined us in the past six months while Lt Col Gallup, the branch chief, departed to return to flying duty. Maj T. W. Moore arrived in August after a one year "training with industry (Honeywell)" tour. Maj Moore has previous R&D experience. 2nd Lt J.D. Wood arrived in September from college and civilian life. At present each officer in this branch is managing at least one major development contract in addition to his regular equipment and program support responsibilities.

HISTORICAL REPORT
1 July 1966 - 31 December 1966
Mechanical Branch
SSVAE-4

Subsystem A

1. **Titan III B/Agena**

The qualification tests of the booster adapter for this vehicle were successfully completed during the last report period. In the last half of 1966, the vehicle made its first flight. The adapter performed satisfactorily during this mission and on subsequent flights which were completed during 1966.

[redacted]

2. **Retrorocket Igniter**

As noted in the last report, acceptance test failures of the existing retrorocket igniter made it necessary to use another igniter. The wiring, documentation, and hardware changes required to use this igniter on the Agena were initiated during this report period. Although the selected igniter had been previously tested and used on flight vehicles, igniter and igniter/retrorocket assembly tests were conducted to verify the performance of the igniter. These tests were successfully completed during the report period.

Retrorockets using the new igniter have been retrofitted on existing vehicles to meet flight requirements. The first of these vehicles is

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scheduled for launch early in the next report period. An in-line production change was also made to incorporate the new igniter in the Thor/Atlas booster adapter kit.

3. Strengthened Booster Adapter

The Thor/Atlas booster adapter was redesigned during the last report period. The primary change consisted of increasing the skin thickness from .143 in. to .160 in. to provide greater strength. This new adapter was made part of an optional kit so that either the Thor/Atlas or Titan III B adapter could be used with the Agena vehicle.

Action was taken to insure that the laminations which were found in the first group of the new booster adapters would be minimized in future units. Production of the adapters was stopped until new material could be ordered and inspected. Manufacture was resumed as soon as suitable magnesium alloy was available. No further production delays have occurred; however, critical inspection of the magnesium alloy sheet and vendor audits are continuing in order to avoid a repetition of the problem.

Early in the report period separation tests of panels simulating the booster adapter separation joint were successfully completed. These were necessary because the magnesium alloy previously discussed was not used in the older booster adapter.

Late in report period the first flight of one of the new strengthened adapters was successfully completed. Vehicle separation was normal. Additional flights are scheduled in the near future. High angle of attack (dog-leg) mission will not be attempted until the static structural tests of the new adapter are completed. The planning and test set-up for these tests was completed in December and the first test was completed just before the end of the report period.

The first phase of the structural test program will consist of heating the adapter asymmetrically and measuring the resulting thermal stresses. The adapter will then be successively loaded with the maximum expected flight airloads and acceleration loads. The latter test will be accomplished with the adapter heated to the temperatures predicted on a mission with no dog-leg maneuvers. In the final phase of the test program the strengthened booster adapter will be heated asymmetrically and loaded until failure occurs.

The previous adapter was not designed to perform dog-leg trajectories. One purpose of the tests on the redesigned adapter is to determine its capability to withstand such flights. The tests at uniform temperature will permit the strength increase of the new adapter to be determined experimentally.. This can be accomplished by comparing the test results to those obtained from a similar test on the previous booster adapter. The tests with the adapter heated asymmetrically will simulate the aerodynamic heating effects of dog-leg maneuvers on the adapter. The temperatures to be applied to the adapter in these tests were obtained from wind tunnel model tests of the Agena vehicle. Thermal and load tests of models simulating the Agena structure have also been conducted recently. The results of these tests will be used to predict and/or verify the stresses in the adapter during the various structural tests. Preliminary analyses indicate that the adapter can withstand the highest angle of attack flights presently planned.

1. Zipcord Program

The first three full ring assembly tests of the selected joint configuration were completed during the report period. A joint simulating the existing Thor/Atlas booster adapter configuration was also tested. A comparison of these tests showed that the zipcord design provides satisfactory separation and produces shock levels which are significantly less than those of the existing separation system. However, a significant problem was revealed by the tests of the zipcord system. In each full ring assembly test the outer jacket of the rubber tubing split open after the joint structure had been severed. Large loops of the inner jacket tubing escaped through the splits. Since these could become entangled in the vehicle during separation, the existing zipcord jacket configurations is considered unacceptable. Pressure is produced inside the jacket by the detonation of an explosive fuse which expands the tubing sufficiently to break the vehicle separation joint. A preliminary analysis and test indicates that the outer jacket is unable to contain the pressure which is present in the tubing after the structure of the joint is severed.

Near the end of report period the zipcord program contractor, LMSC, submitted a plan to analyze the cause of the jacket failures, redesign the zipcord joint, and perform separation tests to determine if the jacket failure problem can be eliminated. This plan is presently being evaluated and a decision to continue or cancel the program will be made in January 1967.

5. Separation Roller Redesign

The redesign of the vehicle separation rollers was completed during this report period. This effort was necessary because tests revealed that the friction coefficient of the previous design was too high to permit proper vehicle separation if one retrorocket failed to ignite.

Load tests of the new design verified that it would withstand the maximum vehicle separation loads. The friction coefficient of the roller assembly was also determined. Separation analyses, using this information, revealed that vehicle separation could be achieved in the time required even if one retrorocket failed. Late in the report period, a successful flight separation of the first vehicle equipped with the redesigned rollers was achieved.

6. Agena Propellant Tank Discrepancies

Several tank problems have occurred during the reporting period to warrant a brief description of each. In no case, however, has a flight failure ever been attributed to a structural failure of the tank assembly. Manufacturing discrepancies have been noted as follows:

a. Soon after the adoption of chem-milling as applied to the oxidizer barrel section of the tank, it was discovered that some pitting of material was evident as well as the appearance of cracks in the weld. The latter was attributed to failing to mask the weld during the preliminary cleaning operation which involves somewhat of a caustic solution. Maskant was thereafter applied to the weld and the thickness of the normal exterior surface maskant was increased to .0~~2~~30 in. to preclude a breakthrough and localized chemical attack.

b. An order of 6061-T4 aluminum material were received by LMSC from a supplier with tensile properties approaching those of aged 6061 T-6 condition. Receiving inspection determined the material acceptable to minimum T-4 Federal Standards and released the material to manufacturing. In two cases welded barrel assemblies fractured on an Arrowsmith Hydrosizing Machine due to the incompatibility of yield strengths between the heat-effected zone and that of the parent material. Final corrective action has involved the additional processing of solution heat treat and quenching prior to hydrosizing. This essentially "freezes" the alloyed material and renders it very workable for a short time. This technique has been judged acceptable in terms of the end product structural capability and the associated cost.

c. During the processing of the tank structure prior to final vehicle assembly, it was evident that greater care would have to be exercised in order to preclude surface discrepancies. As the latter were frequently the subject of numerous MRB discussions and reflected in part a relaxation of workmanship quality. Acceptance criteria for pits, gaughes, and scratches based on tank section strength margins has become part of the hardware specification. In addition the applicable drawings now reflect the general surface quality of the individual sections to conform to Air Force requirements. Action has also been taken by manufacturing in the form of applying a protective vinyl coating to the tank sections to reduce the number of discrepancies.

d. Since Vehicle AD-150 the appearance of crack indications adjacent to the weld has caused several tank assemblies to be scrutinized by contractor/Air Force personnel to determine flight performance acceptability. The sectioning of Tank No. 150 revealed the indications to be surface cracks attributable to the instability of the AC-weld ARC. This unstable ARC would overheat the parent 6061-Al material adjacent to the weld area and subsequent aging would thereby cause the cracking appearance. Additional effort is at present being made to analyze this condition and improve the regulation of the welding process.

7. Determination of Asymmetrical Heating Effects on Standard Agena Vehicles

As previously reported a program of research and development was initiated in the early part of this year to study the effects of asymmetrical heating on the structural capability of the Agena vehicle.

During this report period, the following has been accomplished:

a. The computer program to determine thermal stresses in a ring-stiffened cylindrical shell under an asymmetrical temperature distribution has been completed. This work is presently being documented and upgraded based on structural test data.

b. The wind-tunnel test program conducted at AEDC was completed in this time period. Some discrepant data was taken and certain tests had to be rerun. However, final reduction of data has been completed in the following three areas:

(1) Correlation of experimental pressure and heat-transfer distributions at zero angle of attack with theoretically predicted distributions.

(2) Evaluation of the effect of the test parameters on windward streamline heating of loads at angle of attack.

(3) Evaluation of the effect of the test parameter on circumferential distributions of heating at angle of attack.

Both aerodynamic and thermodynamic analyses will soon be available. One conclusion is that the minimum heating location was at the 120° streamline not 180°.

c. The structural test program at LMSC Palo Alto Facility has consisted of subjecting two aluminum cylinders to asymmetrical heating and measuring resultant temperature distributions and thermal strains. This work has been completed and results are plausible and very satisfactory.

The Palo Alto Buckling Test Program has not been entirely concluded. The study in buckling phenomena has been rewarding in that the loads have been repeatable from which accurate conclusions can be drawn.

d. The thermal-buckling tests conducted at Stanford University have been continuing on as part of a Doctorate Study. The results to date, however, have been most encouraging in that through a study of lateral deflections it has been possible to predict the actual buckling load. This technique will soon be applied during a structural qualification test of the .160 in. Agena booster adapter. The actual test will also verify the accuracy of the computer program previously mentioned.

This total program has produced many worthwhile results that will advance the state-of-the-art of thermal-buckling analyses, moreover the work has proceeded under effective management which is reflected in conformance to original cost estimates.

8. Plumbing Improvement Program (Flared Joints)

It has been previously reported that the technique of flaring CRES and AL tubing on a NASA/LMSC developed orbital flaring machine had been successfully concluded. In effect the contractor has had this capability

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to make high quality production flares since September 1965.

An investigation conducted during this report period revealed, however, that the contractor never revised his manufacturing specification, LAC 0942, to reflect this upgraded capability nor has the actual product quality ever been determined in view of the requirements of NASA specification MC 146. The latter, with its revisions, reflects the highest level of flare quality that exists in industry today.

As separable connector problems have continually plagued launch base operations it is necessary that the Agena vehicle contain orbital flares in all remaining threaded joints. To achieve this objective LMSC has been directed to submit an engineering program plan delineating those tasks necessary to revise the flaring specification, LAC 0942. This document has been submitted to the Air Force outlining an adequate program of work including the recommendation to incorporate higher quality MC threaded fittings and prelubricated B-Nuts and sleeves.

9. Incorporation of Permanent Joints on the Standard Agena Vehicle

During this report period the objective of incorporating permanent brazed fittings in the production vehicle pneumatic systems has been realized. The first such standard vehicle has successfully completed its helium leak check verification but as of this date no launch base experience has been gathered.

The tasks of developing and qualifying the Aeroquip Brazing technique for applications to the Agena system accomplished the following:

a. An Aeroquip induction brazing unit was procured and installed in the Standard Agena final assembly area at LMSC. Work was started to generate documentation that would be required for controlling all phases of this effort. A test plan for the development work was compiled, and general qualification requirements were established.

b. The Standard Agena mock-up vehicle was structurally reworked to the AD-178 configuration for purposes of redesigning the plumbing system to accept brazed joints.

c. A LMSC training program was initiated to qualify individuals in the proper use of the equipment.

d. The separate plumbing systems were analyzed to determine the number of brazed joints that could be incorporated without requiring any component requalification. The final design has included eight (8) brazed fitting in the helium pressurization system and nine (9) in the nitrogen attitude control system. Certain optional hardware kits have also adopted brazed fittings, as have program peculiar installations.

The total effort accomplished under Program Plan 273 required 6,423 man-hours costing $99,112. At this time ECPs to contract AF 04(695)-939 were also submitted by LMSC requesting support in ordering production hardware. The cost associated solely with Standard Agena incorporation has been approximately $300,000 including support of an Air Force progressive inspection.

The major portion of effort has continued in time and work sequence under BOA order #17. Significant accomplishments and associated problems are noted as follows:

a. The development test program consisted of brazing two (2) complete sets of brazed fittings including rebrazements and repair joints on a development test vehicle. The object of this effort was that of training personnel in a production environment and determining through visual and radiographic inspection of the specimens the quality of the brazements and how it correlated with leak-free acceptance criteria. Results although not final revealed very few (less than 2%) visual rejections and no leaks. The appearance of a full, uniform external fillet was concluded to be a good indication of an acceptable joint. Production procedures, however, will require a helium leak test under pressure and the application of a radiographic examination subject to sampling plan direction.

b. The qualification test program was documented in general specification LMSC 1419175 and involved a third set of DTV brazed joints which were incorporated without incident and later subjected to structural and dynamic tests. Corrosion characteristics are at this time being determined. The structural capability of these fittings has been based on a proof and burst pressure ratings of 1.5 and 3.0 respectively which are indeed greater than the 1.2 and 1.6 design ratings for the pressure vessels.

c. Problems of significance in adopting this process to satisfy Agena vehicle requirements have included the certification of certain size tool heads and the availability of effective cutting tools. Care and maintenance of the equipment has also required concentrated attention as his cleanliness requirements.

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Subsystem B

1. Agena Propulsion Performance

During the period of this report 21 Agena vehicles were launched. 18 of these used the USAF YLR81-BA-11 rocket engine and three were Gemini Target Vehicles using the XLR-81-BA-13 engine. Of the 18 vehicles using the -11 engine, all were successful. Ten were single burn and eight were dual burn. Of the three Gemini flights, two were total successes with multiple firings of the -13 engine and the third was a partial success achieving orbit but a chamber pressure anomaly (P_c Dip) on the ascent burn caused NASA to go to an alternate mission plan. A restart was attempted after a five-day coast period and the engine shut down from a turbine overspeed due to a slow acting pilot operated solenoid valve. During this time period both the -11 and -13 engines exhibited the P_c dip anomaly on four occasions. Three were -11 engines and one was the -13 Gemini XII target vehicle. A rapid effort is now underway to determine the cause of the anomaly. Present schedules call for a maximum effort program with a 90 day target completion. All concerned agencies are agreed on this approach.

2. USAF YLR-81-BA-11 Rocket Engines

As indicated, the engines continue to perform reliably with the exception of the P_c Dip problem. Occurrences are now distributed about equally between LMSC and Government procured engines so the problem appears not to be associated with a relaxation of quality on the part of BAC due to the GFP approach to buying engines.

A requirement has been levied by a user to develop a three start capability for this engine since it is considerably lighter than the multi start -13 engine. Procurement and development have been initiated and work is underway.

3. 8247 XLR 81-BA-13 Rocket Engine

The last three Gemini target vehicles were successfully launched during this time period. These were the last flights of the -13 engine within known requirements. The Gemini XII Agena engine Serial No. 810 exhibited a P_c Dip during the first burn which caused NASA to decide against a docked burn of the Agena with the Astronauts. The alternate mission plan included maneuvering with the secondary propulsion system and other activities. After spacecraft splash down, an attempt was made to start the -13 engine after five days of coast, the vehicle was tumbling slightly and no attitude control gas was available. The engine spun up normally but reached a turbine overspeed condition due to a slow opening pilot operated solenoid valve. The automatic overspeed device shut the engine down as the main chamber ignition was beginning. The valve failure was blamed on some form of contamination. No future requirements are known for this engine but the design is proven and the capability demonstrated.

4. 8250 Secondary Propulsion System

Six modules were flown on the final three Gemini Target Vehicles. All performed flawlessly providing ullage orientation and orbit adjustments as required. Many burns were performed by both the 16 lb thrusters and the 200 lb thrusters and all performance was within limits. This design is also proven although no further requirements for the system are known.

5. 8133 Rocket Engine and Integral Secondary Propulsion System

The revised development plan was submitted to AFSC. During later planning sessions it was decided to initiate the augmented program which includes the vehicle changes along with the engine and ISPS work. A preliminary work statement was drafted for a modified definition phase which would define

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development work to be done and total system changes which will result when the new engine and integrated secondary propulsion system (ISPS) are implemented.

6. Pressurization System

Work was initiated which will incorporate the gas fill and propellant vent couplings into the brazed plumbing system. In addition, a longer pad-hold capability will be designed into the oxidizer propellant vent coupling. The pyro helium control valve was redesigned to provide a capability for longer propellant exposure.